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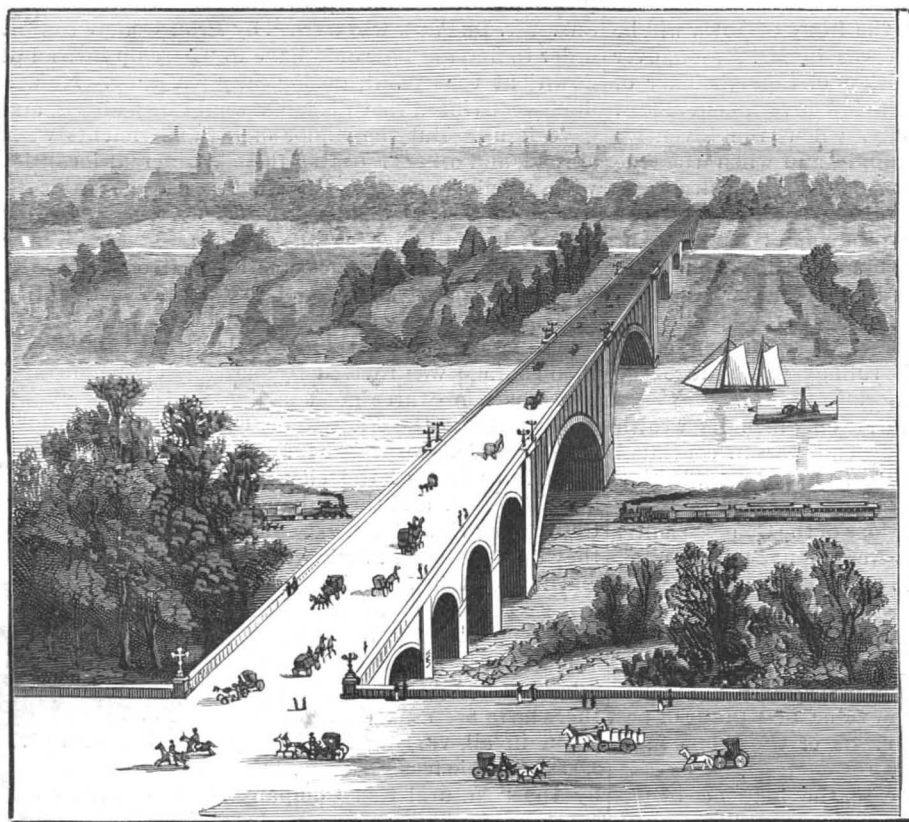

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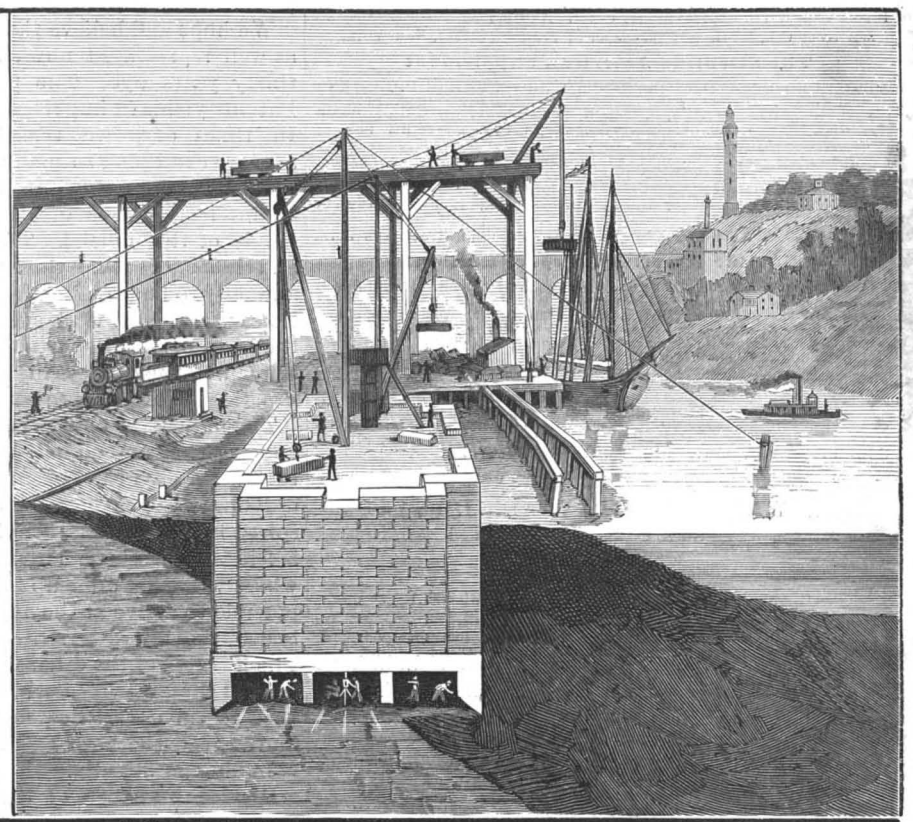

Rand Drill at Work in the Caisson.

Section through Caisson.

SINKING THE FOUNDATION FOR THE HARLEM RIVER BRIDGE AT 181ST STREET, NEW YORK CITY.—[See page 244.]

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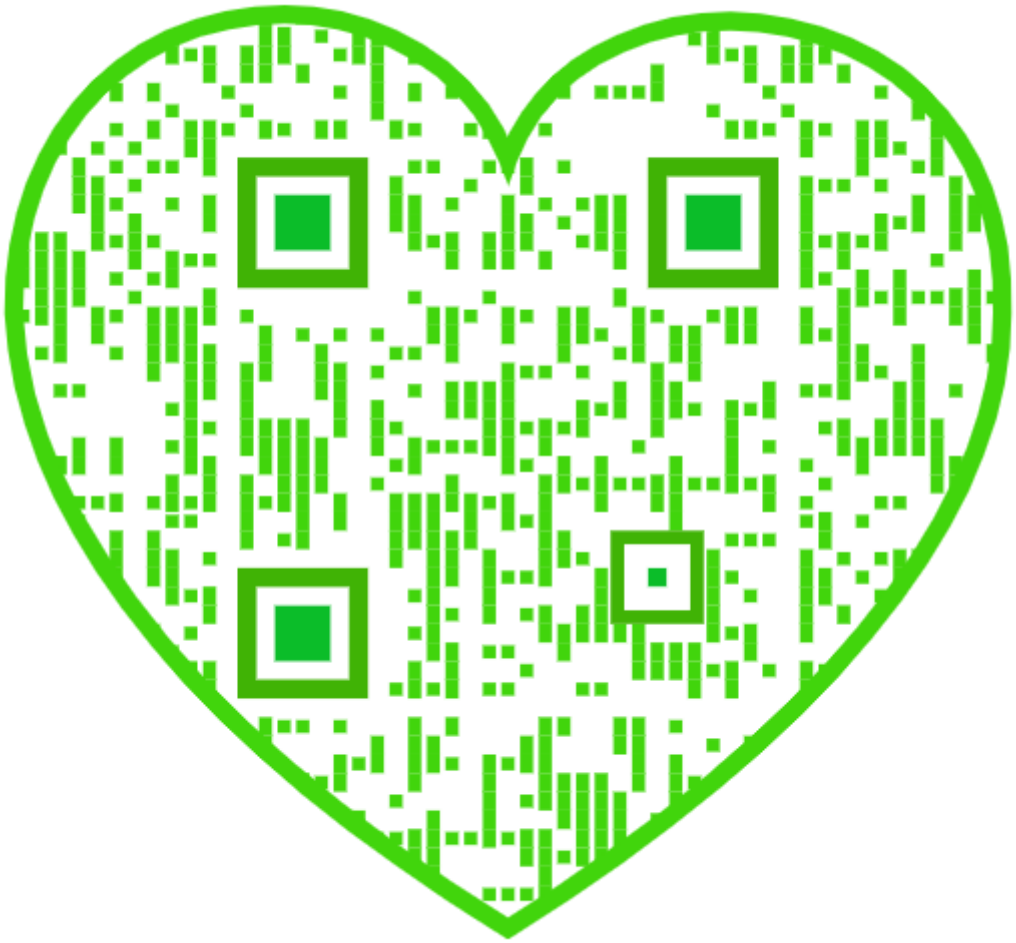

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NEW YORK, SATURDAY, APRIL 16, 1887.

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THE NEW COMMISSIONER OF PATENTS.

The President has appointed the Hon. Benton J. Hall, of Burlington, Iowa, to the Commissionership of Patents. The office recently became vacant by the resignation of the Hon. Martin V. Montgomery. The new official is a lawyer of standing and prominence. He was born in Mt. Vernon, Ohio, in 1835, and graduated at Miami University in 1855. His law practice began in the office of his father, Mr. J. C. Hall, of Burlington. This gentleman, in his day, was regarded as one of the leading and best lawyers of the State. His son is the second Commissioner from the State of Iowa. His predecessor from that State, Charles Mason, was appointed in 1852, his commission dating from the 24th of March of that year, and his term lasting five years.

We hope and believe that the State of Iowa will be as well represented now as it was by Mr. Mason, over thirty years ago. The position of Commissioner of Patents yields in importance to few government offices. In times of peace especially, when the inventive arts are exercising so many minds, and when the true conquests over nature are being won, the arbitrament of interests of the greatest magnitude rests in the hands of this official. The products of the thought and labor of some thirty thousand inventors have annually to be examined, and their claims adjudicated. To carry out this work systematically, the influence of the head of the department should be felt in every bureau. Consistency in his rulings will reduce the practice of the office to a uniform standard.

The industries of the country, on which its wealth and position among nations depend, pass in continual review through the Patent Office. Every modification of its practice, as dictated by court decisions or as inspired by the personal convictions of the Commissioner, is felt far and wide. Patent after patent could be cited whose value has gone up into the millions; and were it possible to arrive at the aggregate value of all patents issued, the interests represented would be enormous. The finances of the other departments of government, even of the Treasury itself, would yield in true importance to such statistics, as the value and profit of patents affects the personal interests of the people individually and directly.

Besides this aspect of the case, the influence of patents and the mode of granting them upon the prosperity of the country, not only in peace but in war, illustrates the importance of rightly filling the office of Commissioner of Patents. The recent legislation in the direction of building up a navy for this country will have a successful issue largely dependent upon patents. The successful gun, its powder, its projectiles, will probably involve many patents, while the ships of war will include in their construction still more. The industries of the nation, by which it lives, are based upon patents, and the defense of these interests in case of war will depend upon the same. It is only by American genius, fostered by our patent laws, that the manufacturers of America are able to compete with the low-priced labor of other countries, and this genius will be called on, if war occurs, to invent methods of defense. The effect of patents is felt upon the arts both of war and peace. The administrator of the office, in one sense, holds in his hands, or has a strong influence upon, the destinies of the country.

The Western judges have rendered some of the best and most enlightened decisions in patent cases. In receiving from one of these States a new Commissioner of Patents, we venture to augur good from the selection. The past record of Mr. Hall entitles us to hold this conviction. If he will continue the work of his predecessor, and gradually bring business up to date, so that less delay will intervene before the consideration of a case, he will be entitled to the thanks of the community of inventors, and he will do the entire country a great service. The coming year may see the delays done away with, and the work of the Patent Office on a regular business basis.

JUDGE MONTGOMERY.

On April 1 the President appointed Martin V. Montgomery an Associate Justice of the Supreme Court of the District of Columbia, to succeed Justice MacArthur, who has retired. The new incumbent is a resident of Lansing, Mich. He was born in 1840, in Eaton Rapids, Eaton County, Mich. He was admitted to the bar in the circuit court for that county in October, 1865. Since that time he has been admitted to practice in all the Federal courts, including the Supreme Court. His private practice in the State of Michigan was very extensive. His first active participation in politics dates back to 1870, when he was elected by the Democrats to the State Legislature. In 1876 he was a delegate to the National Convention at St. Louis. He was appointed Commissioner of Patents in the beginning of President Cleveland's administration, this being one of his first important appointments. The experience of his office as Commissioner should render him a peculiarly valuable addition to the bench of the court in question, before which so many patent cases are brought on appeal from the Commissioner of Patent's decisions.

NATURAL GAS IN INDIANA.

H. C. HOVEY.

At New Albany, Ind., there is a thin seam of bituminous shale whence little rills of petroleum trickle down into the Ohio River. In former days, before the geology of the region was understood, it was supposed that this indicated coal, but now it is known that the shale in question belongs to an older period than the carboniferous. Attempts to use it for fuel were not successful. Last summer, however, the idea occurred to the capitalist, Washington De Pauw, that boring for natural gas might meet with a better reward. He tried the experiment, hoping thus to facilitate the manufacture of glass, in which he is extensively engaged, so as to compete with Pittsburg and other points where fuel is cheaper than it is in southern Indiana. Mr. De Pauw was warned by Prof. Collett that in order to find gas he would have to "bore up instead of down" at that point, geologically speaking. He was finally convinced that his labor would be fruitless, and gave it up. But the rumor of his experiments went abroad, and others repeated them in different localities with varying success. I have taken some pains to collect the facts from authentic sources.

Early last fall a boring was drilled at Portland, near the Ohio line and about forty miles north of Richmond. The result was a small flow of gas, but not in quantity sufficient to be of commercial importance. After this failure matters stood still at Portland for a while, and then courage was revived by successes elsewhere, and now there are three good paying wells at Portland. Two years ago the Ft. Wayne, Cincinnati, and Louisville R.R. Co. prospected for coal at Eaton, a village ten miles north of the city of Muncie. They went down 600 feet, and then abandoned the works. Last October, in view of the experiments referred to above, they decided to sink their wells deeper in search of gas, and found it in a good, strong flow, which gradually increased, until now the discharge is known to be a million cubic feet in twenty-four hours.

The next well was drilled at Muncie (a city of 9,000 inhabitants) by the citizens of that place. Since then there have been six other wells drilled there, making seven in all, varying in capacity from 300,000 up to 2,000,000 cubic feet *per diem*. These wells are controlled by the "Natural Gas Company of Indiana," to the courtesy of whose manager, Mr. C. N. Wilcoxon, the writer is indebted for much of his information. Since then, three good wells have been drilled in Kokomo, three at Marion, and two at Noblesville, smaller and of less pressure than those farther east. The gas is used now in all these places both for purposes of heating and illumination, supplanting everything else.

All these gas wells are found in Trenton limestone, where the rock is porous and the strata have been free from disturbance. In localities where there have been upheavals, there are indications that gas once existed, but escaped through crevices, leaving the rocks barren. The strata vary in their depth below the surface from 850 to 950 feet. Their thickness varies from 30 to 75 feet, and with a very slight dip. The overlying formations are as follows: Soil and drift, varying from a few feet to 250 feet; Niagara limestone, about 250 feet more; then slates and shales till the Trenton limestone is reached.

The field as now developed covers an area of 20 miles wide by 60 long from east to west, and the strata run in a direction from northwest to southeast. The region has been prospected on all sides of this area, but thus far with no success. Borings have failed at Richmond, Shelbyville, Fort Wayne, Union City, and other points. At least fifty wells are now being drilled, besides those now flowing, and until these are completed there is no means of knowing positively whether gas will be found outside the area already indicated.

Expensive experiments are in progress at Indianapolis. A well was drilled there last fall to the depth of 2,100 feet without indications of gas. A number of test wells are now being sunk at Brightwood, a suburb of Indianapolis, but are not yet down to the level of the gas-bearing strata. Of course this development in Indiana, mostly within the last six months, has stimulated speculation. All the towns where gas has been struck are laying systems of mains for supplying domestic and manufacturing demands, and the supply promises to be as constant as it has proved to be elsewhere.

Artificial Whetstones.

The *Guide Scientifique* describes the following method of making artificial whetstones. Gelatine of good quality is dissolved in its own weight of water, the operation being conducted in a dark room. To the solution 1½ per cent of bichromate of potash is added, which has previously been dissolved in a little water. A quantity of very fine emery, equal to nine times the weight of the gelatine, is intimately mixed with the gelatine solution. Pulverized flint may be substituted for emery. The mass is moulded into any desired shape, and is then consolidated by heavy pressure. It is dried by exposure to strong sunlight for several hours.

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The Bell Telephone Company.

The American Bell Telephone Company's annual directors' meeting was held in Boston, Mass., on March 29, 1887. It was called to order by William H. Forbes, President, at 11 A.M. The following are the principal figures, interesting to the public, contained in the annual report read at the meeting. In the year 1886, 9,318 new subscribers were enrolled, as against 2,969 in 1885. The company's wires have a mileage of 14,185; of these, 2,613 miles are underground. The average connections for the year are 312,605,710. Among the improvements promised for the ensuing year are further extension of underground wires, and terminal facilities between New York and Boston and Philadelphia. The Philadelphia line will soon be open to the public, and the Boston line will be completed during the present year. The Canadian company's earnings have increased from $158,000 in 1885 to $190,565 in 1886.

Telephones	$597,749.84
Stock	22,605,925,03
Merchandise, machinery	14,159.71
Cash, deposits, etc	1,691,499.30
Capital stock	9,802,100.00
Bills payable	638,344.67
Patent account	9,373,836.07
Profit and loss	3,352,445.72
Reserves	251,227.24
Surplus	1,491,380.18

Giving a total of $24,909,333.08. The gross earnings for 1886 were $3,097,000, against $2,765,884 in 1885; net earnings for same periods, $1,947,283 and $1,793,196. The dividends paid in 1886 came to $1,176,252 regular, and $392,084 extra dividends.

The above remarkable array of figures is a good illustration of what a patent may be worth. This immense business is built upon a single claim of the single 1876 patent of Alexander G. Bell. All others in the present aspect of things, such as his later patents, and the many other patents owned by the company, are of quite secondary importance. Eventually, their value will appear. A striking item is the patent account of over nine millions of dollars, an amount very nearly equal to the capital stock. The company has acquired such financial strength that whatever the decision of the Supreme Court may be, it can view the limitation or even extinction of the Bell patent with equanimity.

Stomach Digestion.

Opportunities for studying gastric digestion through fistulous openings into the stomach are, thanks to modern surgery, more frequent than formerly. This is important, as the physiology of digestion, as understood at the present day, requires more than the classical instance of Alexis St. Martin to place it on a sound experimental basis. Such a case with experiments *ad hoc* is recorded in the *Revue Scientifique* by Von Herzen, of Lausanne. The subject was a man, æt. 28, on whom gastrostomy had been performed for occlusion of the œsophagus. The observations made were as follows: Bile always appears in the stomach during digestion, but generally only in the later stages. The amount of HCl amounts to 1·8 to 1·9 grm. pro liter; it increases during digestion, and reaches its maximum in the third hour. Sodium chloride appears rather to diminish the amount of acid. When the stomach was empty in the morning but little pepsin was found, and a large amount of propepsin; peptogen accelerated digestion. In the first hour, of a quantity of albumen introduced, two per cent was digested without peptogen, twelve per cent with it. In the second hour, twenty-three per cent was digested without, forty-five per cent with peptogen. In the third hour, fifty-one per cent without, seventy-six per cent with peptogen. These results agree with those obtained by Schiff. Chloral, quinine sulphate, and above all potassic iodide, retard digestion. The author would forbid red wine in disturbances of digestion, but would recommend bouillon and dextrin; blood fibrin is also indicated in many cases.—*Medical Press.*

The Position Taken During Sleep.

A very large number of adults form the habit of sleeping in one particular position, such as lying upon their right or left side. A smaller number sleep upon the back. Some persons sleep with the head greatly extended; more often it is flexed considerably upon the trunk. Many must have the head greatly elevated; others can only sleep with the head very low. Some observations made by Dr. G. Nosovitch (*Wratsch*) upon 235 soldiers showed that 37·5 per cent slept upon the right side, 23 per cent on the left, and 6·5 per cent on the back.

It has yet to be determined whether any particular harm can come from sleeping in a certain position which the individual unconsciously assumes. A popular belief exists to the effect that the liver, being a heavy organ, tends to press upon the other abdominal viscera when a person lies on the left side. At any rate, more persons, probably, sleep on the right side than on the left, as experience and Nosovitch's statistics show. The author in question believes, also, that the posture in sleep influences the extension of a bronchitis. He found, for example, that in the 235 cases referred to, all of whom had this disorder, in 97 it was left-sided, in 72 right-sided, and in 66 on both sides. He thinks that the preponderance of the bronchitis on the left side was due to the fact that there was a greater expansion of this side during sleep, and, consequently, a greater ingress of cold air or of the morbific particles causing the disease.

Some writers have thought that the position in sleeping has an influence upon the passage of fæces through the colon, the position on the right side being especially unfavorable to emptying the colon. Repose on the left side, on the other hand, favors the gravitation of fæces from the transverse into the descending colon, and is therefore to be preferred by those suffering from habitual constipation (J. S. Jewell).

A recent writer has argued strongly for the view that the head should be lower than the feet during sleep, and he claims that more perfect health and greater longevity will result from such approximate topsy-turviness. The contrary position, with the head and trunk considerably raised, sometimes relieves cramps in the legs. It is well known that some chronic nervous affections, more particularly nocturnal epilepsy and some forms of insomnia, are sometimes benefited by sleeping in a partially erect posture.

It appears, therefore, that the posture during sleep is a matter deserving of some attention from physicians, and that some actual therapeutic results may be obtained by looking after its details.—*Med. Record.*

The Largest Powder Charge ever Fired.

The final proof experiment with the first of the 111 ton guns for the Benbow took place at the Woolwich Arsenal Butts on Wednesday, March 9. When it was announced that 1,000 lb. of gunpowder would be discharged, with a projectile weighing 1,800 lb., serious doubts were expressed as to the possibility of the gun surviving the ordeal. The loading of the gun, which will be performed on board ship by hydraulic power, was a difficult and tedious process, but at length the shot was driven forward of the powder chamber, and eight octagonal cartridges were packed in behind it, each weighing 125 lb., or an aggregate of exactly 1,000 lb. The powder was of a slow burning description known as "S. B. L.," and the grains or segments were prisms of about one inch diameter. Most of the rounds in preceding experiments have been fired with Westphalian brown powder, and the velocities have varied with the weight of charge from 1,699 ft. per second, with a pressure of 9·65 tons, to 2,078 ft., with 18·7 tons pressure. The gun, it may be said, is guaranteed to bear a strain of 25 tons and more upon the square inch, a test which in the days of the old and "brutal" powders has often been realized, but is not likely to be ever again applied. The spectators, warned by the alarm bell, got under cover or repaired to a safe distance to see the gun fired, the electric spark was transmitted from the instrument room, and, with a tremendous sound, the gun recoiled at an easy rate up the railed incline on which it stood. The projectile had achieved a velocity of 2,128 ft. per second with the remarkably low pressure of 16·1 tons, and the gun was apparently none the worse for the shock, but a second round was deemed necessary to show that it was uninjured. The only adverse consequences were a few broken windows.—*Admiralty Gazette.*

The Comparative Effects of Heat and of Solar Light.

All the actions of combustion which heat can produce may be also produced by light, but the converse does not hold good. There are many reactions which light alone seems able to set up. All these reactions may be summed up as a disturbance of the primitive molecule which is decomposed into simpler elements. These elements are few in number; they are, if we limit ourselves to volatile bodies, formic, acetic, and butyric acids, methylic and ethylic alcohols, and ethylic aldehyd. These stable groups are generally found the same with one and the same body, whatever the source from which it derives its oxygen. But this is not always the case. Thus lactic acid, if burnt by means of atmospheric oxygen, yields acetic acid, but produces butyric acid if it obtains its oxygen from the salts of mercury. These stable residues of combustion do not pre-exist as groups in the original molecule, but result from a new arrangement of the molecules during combustion. This is proved by the fact that they are found identical in bodies of different types, and are not always the same with one and the same body. These products contain a smaller number of molecules of hydrogen and carbon than the bodies whence they are derived. The sole exceptions to this rule, the formation of formic acid at the expense of oxalic acid, and that of butyric acid from lactic acid, disappear if we double the formulæ of oxalic and lactic acids. Potassium permanganate, which often acts in the cold and in darkness, does not yield other products than those resulting from the action of the sun and of heat. The bodies which it attacks best are those which are found least stable under other oxidizing conditions. But if it does not occasion any novel facts, we may study with it very conveniently the circumstances of the experiment and the conditions of initial and final acidity or alkalinity which determine the result. These last conditions play a great part in the combustions made at the expense of oxygen, free or combined.—*E. Duclaux.*

John Mercer's Process of Alkalization and Oxidation.

Many years ago, John Mercer, the famous old Lancashire calico printer, discovered that, if a piece of calico is steeped for a few minutes in a strong solution (sp. gr. 1·252, or 29° Be., 50·4 Tw.) of caustic potash or soda, it becomes quite gelatinous and translucent in appearance; and after washing out the alkali, it was found to have considerably contracted, so as to render it much closer in texture, stronger, and better adapted to dyeing and printing, having acquired a greater attraction for dyestuffs. He largely utilized this action of caustic alkalies upon the cotton fiber, and took letters patent for the alkalizing process, which is generally known as "mercerization." The microscopical examination of a mercerized cotton fiber shows it to have lost all its original characteristics; it has lost its surfacial markings, its flat shape, and spiral twistings, but appears thick, roundish as if inflated, straight and transparent. A cross section shows that in fact the cell walls have become thicker from the outside toward the center, giving the fiber a cylindrical form and narrowing the interior channel down to an irregular puncture or slit.

A parallel discovery as regards wool was made by Mercer when the French had begun to make their "mousselines de laines," or simply "de laines," the article now plainly denominated as "half woolens," or "cotton worsteds," consisting in woolen warp and cotton weft. This stuff was at a time much in vogue as a fine "French woolen" article, though it cannot be said that it was generally intended as a fraud (at first it may have been) to pass off a mixed stuff for all wool, because the name of "mousseline" (muslin) could be interpreted as referring to the cotton contained in the tissue. When these colors were to be dyed and printed with steam colors, a great difference was found between the two fibers in their capacity to attract the dyestuffs. The cotton threads were distinctly set off by their deep, full color against the much lighter and imperfectly colored woolen threads; the goods were "thready," as it is called. This fault was particularly conspicuous in the blues (Prussian blue) and greens produced with ferrocyanide (also with ferricyanide) of potash and iron salts. Mercer hit upon the idea that wool possessed a deoxidizing property which might be counterbalanced and neutralized by some process the reverse of the mercerization process, and he found that by a passage in an acid bath of bleaching powder the object was perfectly accomplished, the wool fiber being deanimalized as it were, that is, oxidized by the mixture of acid and bleaching powder, which was known to possess great oxidizing power. He tried chromic acid, or in its place a mixture of bichromate of potash and sulphuric acid, and hydrochloric acid with bleaching powder, but retained the latter, because the former two, although effecting the desired oxidation, gave the wool a yellow color, while the chlorine left it perfectly white.—*Textile Colorist.*

Turkey Red from Castor Beans.

A. Braunstein has taken a German patent for the direct production of Turkey red oil from oleaginous seeds, as follows: The oil seeds, castor beans preferably, are first freed from their shells by passing them through horizontal rollers, then washed, and treated with strong sulphuric acid of at least 66° Be. The acid may be mixed with the seeds, and the mass ground up together; or the seeds are ground to a fine meal and treated with the acid in a suitable vessel with a stirrer, and which can be kept cool. After 40 to 60 per cent acid has been gradually added and stirred together with the meal, the mass is allowed to rest for several hours, when the sulphated oil, which has separated out at the top, is drawn off. The sediment is then washed out with two waters, to extract from it the remaining oil, and the washing waters being added to the first product, the whole is again allowed to stand for several hours, when some common salt is added to completely separate the sulphated oil, which is then neutralized with ammonia or caustic soda in the ordinary manner.

Remarkable Tunnel Work.

For some time past there has been much friendly rivalry between the foremen and their men in the several headings of the new aqueduct for supplying this city with water, concerning the amount of work that could be done in a certain time. The best record, so far, is for the week ending February 26, during which time the south heading of shaft 15 was driven 102 feet, the section removed measuring 9 by 17 feet. The men worked but thirteen shifts, so that the time was not quite a full week. Three Rand Slugger drills, No. 13, were employed, and rackarock powder was used. No time was lost by the use of this explosive, as there was no delay required in order to permit the gases generated by the explosion to escape, as would have been necessary had dynamite been used.

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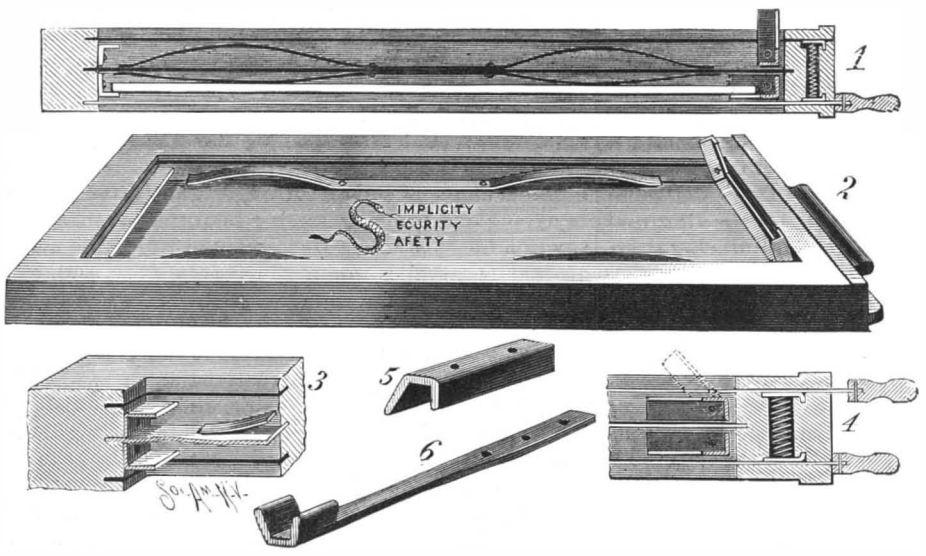
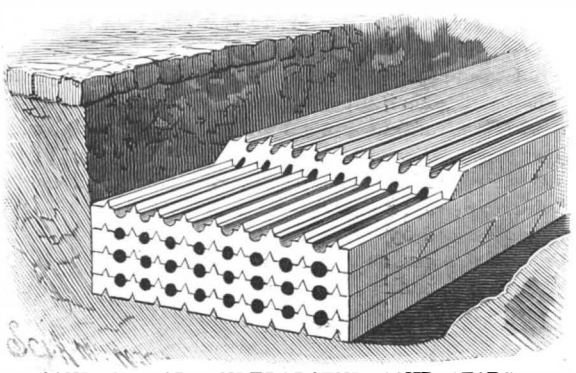
WARNER'S IMPROVED DRY PLATE HOLDER.

One of the most serious annoyances a photographer has to contend with in the present day of lightning dry plates is a leaky plate holder, particularly when the latter is composed of one or more separable parts, since the slightest trace of light entering at some minute crevice will frequently damage a day's work. By its simplicity, solidity, and ease of operating, the holder here shown possesses features very desirable for out of door photography, in that it is perfectly light tight, strong, and compact.



WARNER'S IMPROVED DRY PLATE HOLDER.

Fig. 1 represents a longitudinal section, in which the upper slide is withdrawn. The body of the holder consists of a light hardwood frame, having a metal septum or division in the center, upon each side of which are riveted very light flat steel springs, shown clearly in



CONDUIT FOR UNDERGROUND CONDUCTORS.

Fig. 2. In the lower half of the holder (Fig. 1) may be seen a plate in position. An angular metal strip is rigidly secured on the left hand end of the inside of each plate compartment, intended to hold one end of the sensitive plate, while at the opposite end is a movable or pivoted angular strip or clamp provided with projecting ends, which, when thrown up, permits the sensitive plate to freely drop down into the holder, resting, as it were, upon a bed of springs.

To insert the plate, the holder is held with its narrow end resting on a support at a slight angle, then the exposing slide is withdrawn, and the plate, film side out toward the operator, is slid over the spring under the left hand angular strip. In this position the other free end of the plate projects slightly above the holder. The right hand clamp is now turned down over the end of the plate, pressing the same down into position. The springs compensate for any variability in the thickness of the glass. Hence the film side of the plate remains always in the same plane and in focus. The exposing slide is next inserted, and the holder is filled ready for use.

Special cut off light valves, consisting of plates with one side bent down, forming an angle, to prevent slipping, and also arranged to fly outward by a miniature spiral spring between them, as the slide is withdrawn, and effectually close the slit, may be seen in Figs. 1 and 4.

In removing the sensitive plate, the pivoted clamp is first turned up. At once the springs underneath force one end of the plate up and out of the holder, when it is easily caught with the fingers and slipped out. This feature of the holder is quite important, since in ordinary holders the operator is obliged in many cases to dig out, as it were, the plates with the fingers, being very apt to injure or scratch portions of the film. Fig. 3 is an enlarged view of the rigid angular strip. Fig. 4 shows the pivoted clamps down, when holding the plates. The dotted line indicates the position when thrown up.

Fig. 5 represents another form of a rigid angular strip, intended to be substituted for that shown in Fig. 3, with the bevel side downward, and in conjunction with two spring clamps, bent in the shape of a half bow, secured to the inside end of the holder in place of the pivoted clamp. With this latter device the plate is inserted by dropping it into the metal beveled strips and pulling back, with two fingers, the spring-forked strips. When these are released and fly forward, they securely grasp the plate. To remove the latter, the forked strips are pressed back, allowing the plate to be lifted out. Pivoted flat pieces of brass on the inside of the holder (not shown) are arranged to hold the spring forks back while the plate is put in or taken out. The bevel shape of the stationary clamp is intended to accommodate different thicknesses of glass. The holder being made in one piece is perfectly tight, while the arrangement of the clamps permits uneven and rough-edged plates to be quickly and easily inserted.

Further particulars may be had from the patentee, Mr. M. P. Warner, 69 Lincoln Street, Holyoke, Mass., who, we understand, desires to negotiate for the sale of territorial rights.

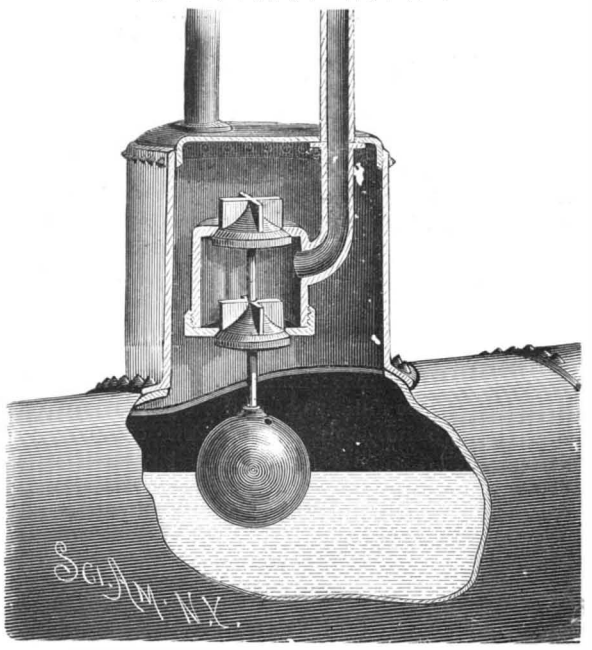
CONDUIT FOR UNDERGROUND CONDUCTORS.

The object of the invention herewith illustrated is to provide for the perfect insulation and protection of underground conductors. In constructing such a conduit, each of a series of glass plates is provided with longitudinal recesses upon both upper and lower surfaces; the recesses in the upper face of one plate are arranged to register with those in the lower face of the other plate. Each plate is also formed with longitudinal ribs upon one face and with correspondingly shaped grooves in the other face, so that when one plate is applied to the other, the ribs will enter the grooves and the plates will be held against lateral movement. In building a conduit, the plates of one layer or series are arranged so as to break joint with those of the other layers, a proper binding material or cement being interposed between each series. This binding material holds the plates together, and insures the perfect insulation of the wires. By varying the size of the recesses, the plates may be arranged to receive single wires or couples of such size as may be required. The wires are insulated from the earth and from each other, and are protected against the action of water.

This invention has been patented by Messrs. Hans Loesner and M. De Bravura; further particulars may be obtained by addressing the former at No. 84 West Broadway, New York City.

FEED WATER REGULATOR.

The accompanying engraving represents a balance valve feed water regulator which is entirely inclosed within the steam and water chamber in which it acts, and which requires no stuffing box for its stem, to impair or interfere with its freedom of action. In the engraving, the device is shown situated in the dome of a boiler. At the delivery end of the pipe leading from the pump

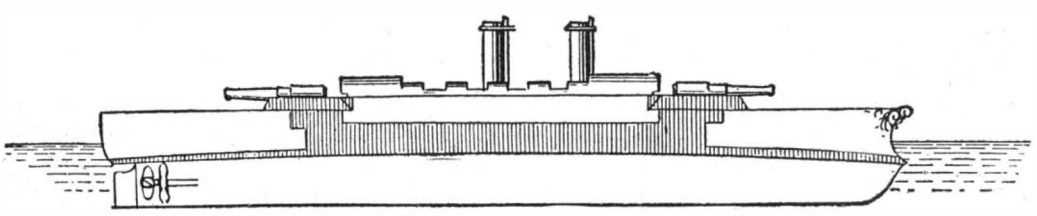


ADERHOLD'S FEED WATER REGULATOR.

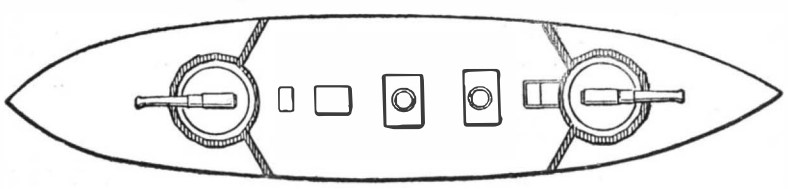
is a valve box made in two sections, screwing together, and fitted with two disk or puppet valves, one of which is arranged to close an opening in the upper section, while the other closes an opening in the lower section. These valves are connected by a common stem, so that they virtually form but one balance valve, which opens downward. Each valve is formed with wings or guides, arranged to fit the openings, for the purpose of steadying and directing the double valve in its movement. The lower valve is connected by a central rod with an open float, as shown.

It is evident that as the water lowers, the valve will descend and permit the passage of steam through the outlet pipe to the pump or injector, or to a whistle. And when the water again reaches its normal level, the valve will be closed by the float, to which steam is admitted to equalize the pressure and prevent collapse. This action of the valve is automatic, and in case of any sudden leak in the boiler, unnoticed by the engineer, the valve will open to admit of the pump supplying more water. And it may, if desired, be made to blow a whistle or give an alarm in case of the pump failing to supply water, by using an extra valve for that purpose. The valve moves easily, without friction, and is perfectly balanced. When one pump is supplying more than one battery of boilers, the regulator is placed at the discharge end of the feed pipe, either above or below the float; if above, the opening in the float is protected, so that water cannot fill it as it enters the boiler.

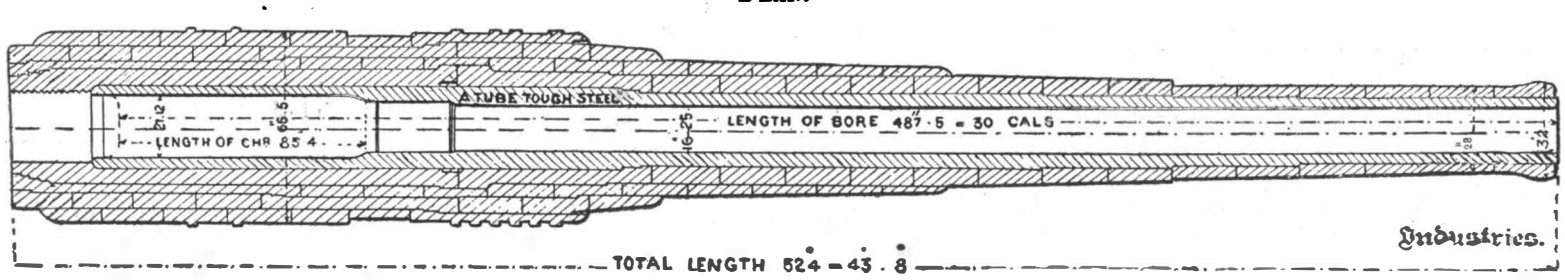
This invention has been patented by Mr. Alexander J.



ELEVATION.



PLAN.



LONGITUDINAL SECTION.

THE NEW 110 TON GUN FOR H. M. S. BENBOW.—CHARGE, 900 LB.—PROJECTILE, 1,800 LB.—[For description see page 245.]

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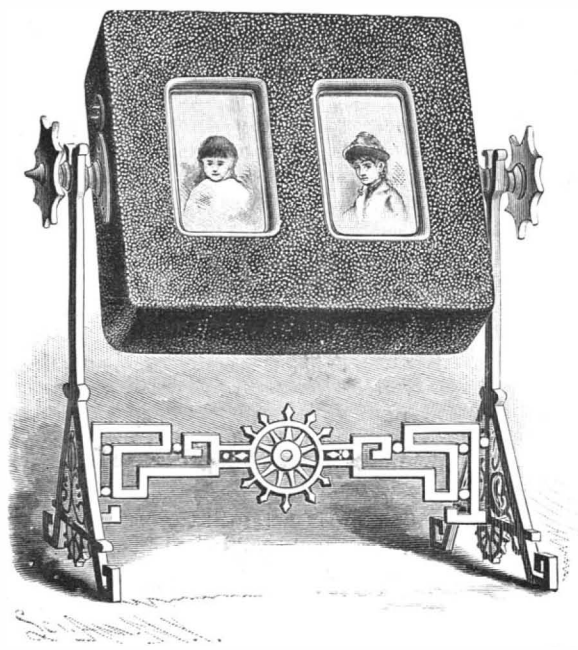
Aderhold, whose address is care of Birmingham Ice Factory, Birmingham, Ala., at which place one of these regulators is now in use. One-half interest in this patent is for sale.

A NOVEL PICTURE EXHIBITOR.

The simple and inexpensive device here illustrated is for showing pictures, especially photographs. It is artistic in appearance, and may be easily handled to allow the pictures to be viewed with greater comfort than by means of an ordinary album. The picture-



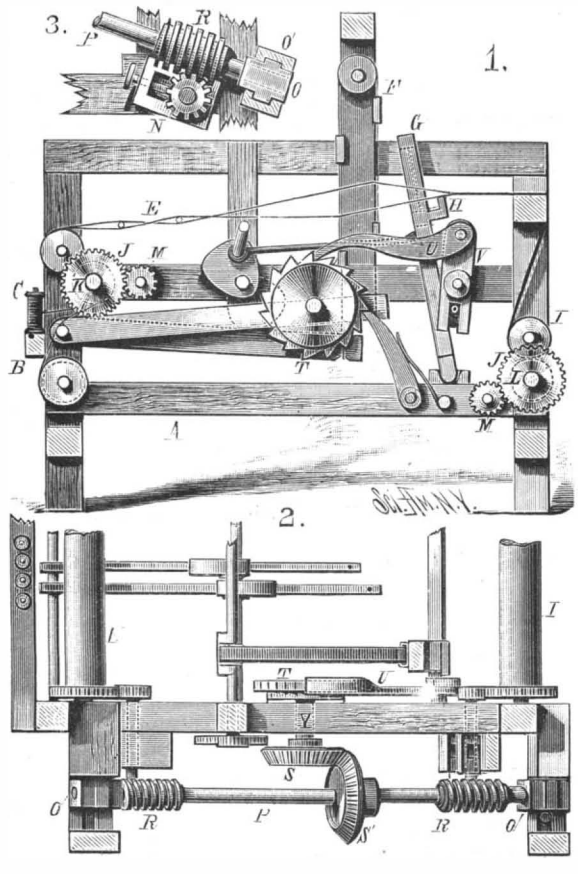
BOOS' NOVEL PICTURE EXHIBITOR.

holding case is made with a main body portion to which is hinged a cover or lid, and both the front of the body and the cover are formed with suitable openings, through which the pictures may be viewed. The case is provided with fixed opposite end studs, journaled in the forked upper ends of side posts fixed to an ornamental stand. The studs have neat hands, which may be grasped conveniently to slowly rotate the case on the stand. Within the case are picture slides, so arranged that as the case is revolved the pictures will appear in rotation before the openings. The pictures are so arranged that part may be seen through the openings in the body of the case and the others through the openings in the cover. The capacity of the case, or the number of pictures it will contain, depends upon its depth. There is no complicated mechanism to get out of order, as the parts are all very simple.

This invention has been patented by Mr. Arthur M. Boos, of 570 Main Street, Buffalo, N. Y.

TAKE-UP AND LET-OFF MECHANISM FOR LOOMS.

By means of this mechanism a given length of warp is let off intermittently from the warp spools or from



WILLIAMS' TAKE-UP AND LET-OFF MECHANISM FOR LOOMS.

the warp beam, as the case may be, in weaving, and the cloth taken up as woven. Fig. 1 is a side elevation of a loom for weaving cloth, with this improved mechanism attached; Fig. 2 is a top view of a part of a loom, showing the take-up and let-off mechanism; and Fig. 3 is a detail view. In the drawings, A is the frame of a loom of the usual form and construction, upon which are mounted the several operating parts employed in weaving, consisting of the creel, B, with the spools, C, thereon, warp, E, let-off roller, K, heddles and harness, F, lay, G, having race board, H, cloth roller, I, and take-up roller, L. One of the two similar cog wheels, J, is secured to the end of a let-off roller, K, and the other is secured to the take-up roller, I. These wheels are geared into pinions, M, mounted upon shafts, to the opposite ends of which are secured like pinions, N, which mesh with worms, R, on the ends of a shaft journaled in bearings on the outside of the frame. Near the center of the shaft are two bevel wheels, S S', having an equal number of teeth, and one being upon the shaft, P, while the other is upon the shaft, Y, at the other end of which is mounted a ratchet wheel, T.

To operate the ratchet wheel at the proper time to let off, through the mechanism connected therewith, the required length of warp at each beat of the lay, a pawl, U, is pivoted to the upper end of the vibrating lever, V, the lower end of which is slotted to receive a pin extending from the lay, so that at each beat of the lay the pawl will turn the ratchet wheel a given distance, by which the let-off roller, K, is revolved to supply the length of warp required, and the take-up roller, L, revolved to take up the woven cloth on the roller, I. The latter roller is driven by friction by the other, upon which it rests, so that it will take up the same length of cloth as the roll increases in diameter. Above the let-off roller, K, is placed an independent friction roller, the warp, E, from the spools passing between these rollers. To vary the length of the warp to be let off, the pinions, M, are changed to larger or smaller ones, as the case may require. To permit the worms to be disengaged from the pinions for shifting the latter, and also to enable the weaver to draw up the cloth to have access to the interior of the loom for repairs, the bearings, O, of the shaft slide outward on the brackets, O'. A stop pawl prevents the backward movement of the ratchet wheel.

This invention has been patented by Mr. Matthew Chapman Williams, of Wilkinsonville, Mass.

Passenger Lift for the Eiffel Tower.

The enormous height of this proposed French Exhibition tower renders a hydraulic lift, in which passengers could perform the whole journey in one operation, quite impossible; and a succession of shorter lifts, requiring frequent changes, would naturally be considered too cumbersome by the public who will use the tower. On the other hand, the employment of a winding engine and a lift similar to those used in mines would not be sufficiently safe, and for these reasons M. Eiffel has devised a new type of lift, in which the whole ascent can be made in one journey, while at the same time it presents absolute safety. The main idea of the lift is that of a huge screw and nut. Below the lift cage is placed a trolley, with three or more wheels running upon an equal number of rails, which ascend spirally, and thus form a screw having so many threads. The trolley will be revolved either by an electric motor or by a water engine; but the cage will be prevented from revolving by guide bars. Thus the passengers will not feel anything of the rotary motion of the trolley underneath; and by selecting the pitch of the screw sufficiently small, any degree of safety against a too rapid descent can be obtained.

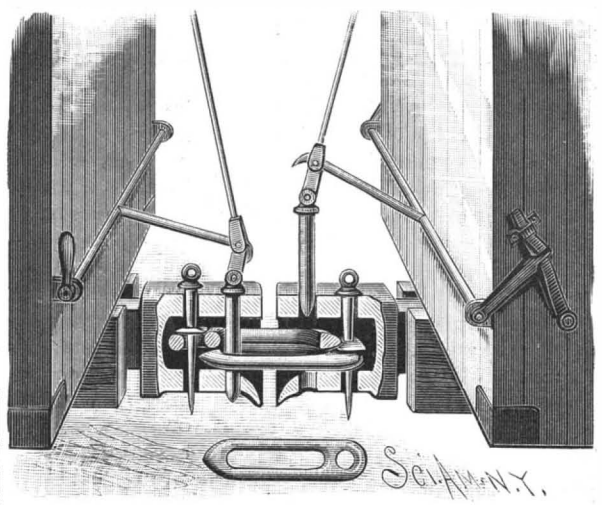
Gluing up Stock.

When the pattern maker is at work on a very thin pattern, he is obliged to use his stock made in two parts glued together, so as to bring the grain of the wood across each other, to keep the pattern from splitting; but there is another tendency to be provided for. A very little of the shrinkage in wood comes with the grain; it is nearly all found in its width, and the Boston *Journal of Commerce* says it makes one of the best hydrometers when glued together crosswise, curling and warping the stock in both ways, a feature that is not desired in pattern making. Besides, the ends are very likely to show by extending beyond the finished work as soon as the least change takes place in the absorbing of moisture; and in many respects it would be much better for the pattern if the right angle grain laying was not resorted to in the make-up of the stock. When two thin parts are to be glued together for the purpose of avoiding the tendency to split, they can be placed at a slight angle with each other, instead of at square across with the grain. This will give them all the cross laying that is required, and avoid much of the tendency to warp or shrink away from the edges.

IMPROVED CAR COUPLING.

The drawhead is provided with the usual link recess, and is formed with two sets of coupling pin apertures, one being arranged to receive a retaining pin formed with a tapering point, while the other receives a removable coupling pin. The latter pin is connected to an arm carried by a horizontal cross shaft mounted in brackets on the end of the car. Each end of the shaft is provided with lever arms, one of which is arranged to engage with a notched spring, so that the coupling may be held in a raised position, as shown at the right in the engraving. The coupling link, shown in the lower part of the cut, is formed with a slot and a circular aperture through which the retaining pin passes, while the slotted end extends outward beyond the drawhead. The outer end of the link is pointed, and the forward edges are rounded off. In order to hold the link in a horizontal position, the retaining pin is provided with a flange which rests upon the link, the weight of the pin thus serving to hold the link in proper position.

By making the pins tapering, they may be firmly seated within or disconnected from the flanges. When the cars are to be coupled, the coupling pins are held in their raised position. As the cars approach, the ex-



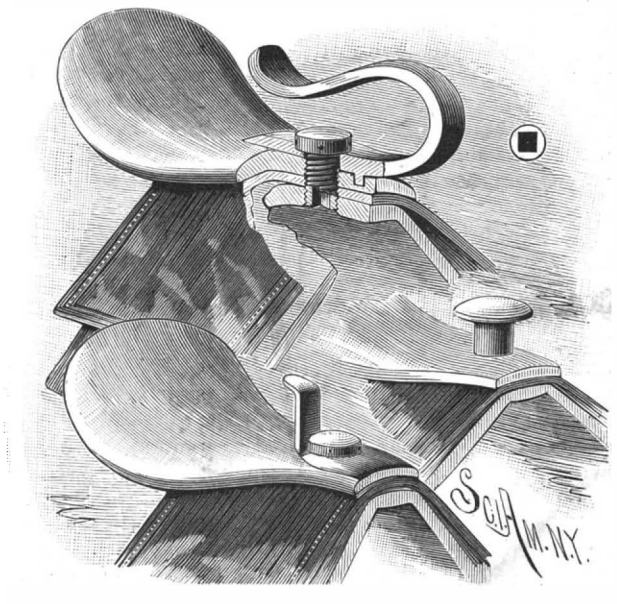
DIETZE'S SAFETY CAR COUPLING.

tending ends of the links will enter the recesses of the drawheads, one link riding above the other; and when they have reached the position indicated in the engraving, the levers are released from the springs to permit the coupling pins to fall through the links and couple the cars. In operating this coupling, it is unnecessary to enter between the cars either to couple or uncouple. Suitable rods are provided, in order that the parts may be manipulated from the top of the cars.

This invention has been patented by Mr. August O. Dietze, of Syracuse, Nebraska.

IMPROVED SADDLETREE AND CHECK-HOOK.

The saddle is fitted upon the upper side of the saddle tree, and is formed with an aperture coinciding with a screw-threaded aperture in the center of the tree. The lower portion of the check-hook fits upon the saddle, and is formed with an aperture to coincide with the two others, so that the hook and saddle may both be secured to the tree by a single screw inserted from the top. In this arrangement there is no danger of the screw working out, and it is impossible for it to come in contact with the horse's back and do injury. The head of the screw is formed with orifices for turning it beneath the upper part of the hook, and the lower end of the screw is formed with a square socket, as shown in the small cut, extending up into the screw, so that in case of breakage a square instrument may be inserted in the socket from the upper side of the tree for turning out the remaining portion of the screw, so that a new one can be turned in. This permits of having the repairing done without injury to the saddle. The check-hook is prevented from turning upon the screw by a small stud project-



PALMER'S IMPROVED SADDLETREE AND CHECK-HOOK.

ing from its under side, and entering a recess formed in the saddle. The two lower views in the engraving illustrate different forms of check rein holders.

This invention has been patented by Mr. D. W. Palmer, of Detroit, Maine.

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SINKING THE FOUNDATION FOR THE NEW HARLEM RIVER BRIDGE.

The foundation for the center pier of the bridge now being erected over the Harlem River at 181st Street, this city, is rapidly nearing completion. The bottom of the caisson now rests upon solid rock at a depth of forty-five feet below the surface of the river, and the air-chamber is being filled with concrete; the masonry of the pier is now being rapidly carried up. The bridge consists of two metallic arches, each 510 feet clear span, one of which spans the entire width of the river, and the other the whole distance from the easterly bank of the river to Sedgwick Avenue. Each span consists of six separate steel-plate arches, spaced 14 feet between centers and connected by bracing. The floor system is carried on vertical columns supported by the arches. The floor is 80 feet wide, and consists of a roadway of 50 feet and two footwalks of 15 feet each. The grade of the roadway is 150 feet above mean high tide. The arched masonry approaches are as nearly symmetrical at both ends as practicable.

The work of sinking the foundation for the center pier of the bridge is of particular interest, owing to the nature of the material to be passed through and its peculiar disposition. Borings showed that about fifteen feet from the surface of the water the eastern edge of the foundation would encounter rock, sloping downward at a sharp angle toward the center of the river; on this rock lie the soft mud and sand of the river bed. During the greater part of its downward journey the caisson rested both upon rock and mud and sand, and the work of sinking it vertically was, therefore, rendered extremely difficult, since there was a constant tendency to shift or move sidewise toward the river. This formation of the rock made necessary the extensive use of explosives, and it is most probable that in this instance more rock was removed by blasting than in any other similar work ever undertaken. The size of the drill holes and the quantity of explosive used were not influenced by the fact that the discharge took place in compressed air confined in a comparatively small chamber in which the men were. There was a possibility of the caisson being injured by flying fragments of rock if too large charges were used, and this consideration alone controlled the quantity of explosive of each blast.

In a closed chamber like a caisson, the replacing of foul by pure air is a very slow operation; and as the condition of the men depends directly upon the purity of the air they breathe, it is of vital importance to preserve it in its normal state by preventing pollution. Such being the case, it naturally follows that of different explosives of equal power, the one producing the least hurtful gases is best adapted for all work which cannot be quickly and thoroughly ventilated. In this caisson both dynamite and rackarock were tried, and the experience gained concerning the effects produced upon the men by breathing the gases resulting from the explosion of each is of great value.

The caisson was designed, and the foundation built, by Messrs. Anderson & Barr, of this city. The bottom of the caisson measures 54 by 104 feet, the dimensions of the top being one foot less. The roof is six feet thick, and is built up of pine timbers one foot square laid in courses running in different directions. The side walls are three feet thick, and are also made of timbers one foot square; the outside and inside courses are horizontal, while the intervening course is vertical. The inner lower portion of each wall is beveled off to form a shoe or cutting edge, which is 9 inches wide and is protected by an oak strip. The outside of the walls is covered with a three inch sheathing, and the entire interior is sheathed. From the bottom of the shoe to the top of the caisson is 13 feet, and the interior is 7 feet in height from shoe to ceiling. The chamber is divided into three compartments by two longitudinal partitions, which are two feet thick by five feet high and in which are formed suitable openings that serve as passage ways. The bottoms of the partitions and of the side walls are connected by heavy timber struts and iron tie rods.

In the center of the roof is placed the supply lock, through which all excavated material is passed and all supplies received. The shaft of the lock is 5 feet in diameter, and extends up above the surface of the water. To the bottom of the shaft, which just enters the chamber of the caisson, is attached a rectangular air lock provided with doors at two opposite sides, so that the loading and unloading of the lock can be carried on simultaneously from two points, the work being thereby expedited. At the bottom of the shaft is a third door, opening downward or toward the interior, as do the other two. It is evident that when the shaft door is closed, the others may be opened without permitting the escape of air; and when the two inner doors are closed and the air admitted to the lock to make the pressure equal to that in the caisson, the shaft door may be opened. The excavated material is placed in buckets in the lock and then raised by hoisting machinery and dumped into cars at the top.

The lock for the men is placed at the top of a shaft extending through the roof, a ladder furnishing the means for ascent and descent. This lock is 12 feet long by 4 in diameter, and is provided at each end with a chamber closed by two doors opening inwardly. As this forms two independent locks, no time is lost in waiting, as one lock may be always entered from the interior, and the other from the exterior. Although eight or ten men can crowd into one of these locks, their small size is a decided advantage, since one man can pass without the loss of much air.

On account of the rock, the method of sinking the caisson was somewhat different from that usually followed. In the solid rock under the shoe, and in the large fragments, the holes were drilled by hand; but in the center of the chambers the drilling was done by a Little Giant drill * No. 3, of the Rand Drill Company, which was supplied with air at 80 pounds pressure, and as the greatest pressure in the caisson was about 18 pounds—the depth sunk below high water being about 45 feet—there was ample power to run the drill effectively. The pure air thus supplied was also an advantage. This drill was well adapted for the work, as it could be easily moved from place to place, could be quickly set up so as to drill at any required angle, and required no particular attention. The adjustable tripod upon which this drill is mounted renders the tool of special service in work where there is not much room, and where it is necessary to drill the holes at almost all conceivable

MIXING THE INGREDIENTS OF RACKAROCK.

angles. The tripod legs are telescopic, and may be lengthened or shortened to accommodate uneven ground. After a blast, the loose rock was removed from under the shoe, and earth was put in its place. When all the rock under the edges had been removed to a depth as deep as it was practicable to go at one time, and earth had been packed under the shoes, the caisson was in condition to be sunk, as it was supported wholly by earth. The earth was removed, a little at a time, at intervals around the entire shoe, and as the supporting power of the earth was thus diminished, the caisson gradually settled down. Its downward progress was closely watched, four stakes, one in each corner, forming guides that indicated the settlement; and if one side advanced more rapidly than the other, the earth was repacked under its shoe, so as to offer more resistance and retard that side. In this way the caisson was sunk vertically, and so truly and evenly that, when it finally rested upon its bed, the four corners and the center did not vary an inch from being in the same horizontal plane.

As the caisson descended, the masonry of the pier was added on the top. This furnished the weight necessary for overcoming the friction upon the outside.

In an engine house located just across the railroad tracks are the compressors for supplying air to the caisson, and a separate compressor for the drill. The electric light plant consists of a dynamo capable of running seventy-five 16 candle power incandescent lamps. The experience of Messrs. Anderson & Barr has shown that in interior work such as this many lights of small power distributed through the chambers afford a much better illumination than a few arc lights arranged at long distances apart, and their use does away with the annoyance caused by the carbon dust of the arc lights.

At the time of blasting, the men pass into the furthest chamber, so that the intervening partitions, or partition, if the blasting takes place in the center chamber, will prevent the passage of flying rocks. Care is also exercised to keep out of line with the openings in the partitions; and in order to raise the feet, so they may not be struck by rocks passing under the partitions, which are but five feet in height, the men generally climb upon some of the cross braces. The effects produced by the discharge are very different from those caused by the same quantity of a like explosive fired in the open air. The sound is decidedly duller, and although its source is apparently very close, there is no sharp and sudden concussion. Even the simultaneous explosion of five 1½ inch cartridges of rackarock produces no unpleasant sensation whatever upon the ear. But the effect upon the caisson was certainly startling. The waves of air seemed to bound from one wall to the other, causing heavy vibrations of all parts of the structure. This disturbance continued several seconds, and the motion could be distinctly perceived some time after all sound had ceased. The sound did not die away in the distance, but even when last heard appeared to be in the chamber.

During the first part of the sinking, dynamite was exclusively used, and after each firing the men complained of severe headache, and suffered from nausea. These troubles were caused entirely by the gases generated by the dynamite, and their severity depended directly upon the quantity used at one time—a small charge not vitiating the air to such an extent as a large one, and consequently not creating such disagreeable results. The pains continued until the constant inflow of fresh air either displaced the hurtful gases or so reduced them as to render them harmless. The danger always attending the handling of dynamite cartridges was another great disadvantage, especially in work of this character, where, during the charging, the holes were surrounded by workmen.

Rackarock was then tried, and its better adaptability for all operations in closed chambers was conclusively demonstrated. The fumes generated by it were comparatively harmless; nausea disappeared completely, and there were but few and slight cases of headache, while the immunity from risk in handling it lessened the anxiety of all connected with the work. This explosive, as is well known, consists of two ingredients, a fluid and a solid, which are shipped and delivered to the consumer in separate packages, and each of which is absolutely non-explosive. When needed, the two ingredients are combined by pouring a certain proportion of the fluid over the solid, which is contained in a bag of the usual cartridge form, as illustrated by the engraving upon this page. In a few seconds the oil has thoroughly saturated the cartridges, one of the tied ends of which is then cut, the cloth case opened, and the fuse inserted, when the end is retied and the cartridge is ready for use in the ordinary way. Enough of the ingredients may be mixed to produce charges for a single blast, a shift, or a week's work. This explosive is as powerful as dynamite, is safer to handle after the ingredients have been mixed, and for all tunnel and mining work, where it is difficult to quickly change the air, it is decidedly superior.

After the caisson had been carried down so that almost the entire shoe rested upon solid rock, the rock was cleaned of all debris and the three chambers completely filled with concrete, the filling being commenced at the corners and carried toward the shafts. Sand and Portland cement, in the proportion of 1 cement to 2 sand, were mixed and moistened outside and introduced through a long lock, consisting of a tube 18 inches in diameter, extending from the caisson to the surface, and provided at each end with a door. Upon the lower door being closed, this shaft was filled with sand and cement, when the upper door was closed, the compressed air admitted, and the load allowed to fall into the caisson.

The two main shafts were extended from time to time, as the caisson descended, by additions secured to their outer ends. As the lock for the men was at the upper end of the shaft, it was necessary to close the lower end while the air lock was removed and an additional length of shaft put on. The inner end of the shaft was closed by a heavy timber piece, fitted air-tight on it. Upon the escape of the compressed air from the shaft, the pressure in the caisson served to hold this cap firmly in place.

* This is the first instance of a power drill being used in any work subjected to compressed air.

New Process for Making Steel Pipes.

The new method of making steel pipe at Barbach, Germany, is said to be very successful, and the process of manufacture is briefly as follows:

As soon as the steel is cast into the round mould, a core is thrust into the steel, so that the tube is formed between it and the sides of the mould. In order to prevent cracking of this annular casting during cooling, the core is made up in such a manner that it follows up the shrinkage of the steel. The steel cup thus obtained may then be rolled in an ordinary train. It is stated that a large firm in Paris proposes to apply the method to the manufacture of copper tubing.

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THE NEW 110-TON GUN.

The 110-ton gun now undergoing its firing proof at Woolwich must be regarded as a fine specimen of the most recent practical achievement in very heavy guns. It is true that Krupp has supplied four ordnance of 118 tons to the Italians, but the power of guns does not depend entirely upon their weight, and we believe that our piece has already shown itself superior to its German rival, by delivering a heavier blow than any which has yet been given, as far as our information goes, although the heaviest charges have not yet been fired from the English gun.

To lay before our readers the plan on which the power of a heavy armor-piercing gun is estimated, and how it may happen that a comparatively light strong gun of good design may be superior to one of heavier metal, we may compare the gun now under trial with the four 100-ton R.M.L. guns purchased by our government in 1878 from Sir W. Armstrong & Co., when the famous £6,000,000 was hurriedly voted for war stores. These four guns are now mounted on the fortifications of Malta and Gilbraltar; but although only a few years have elapsed, designs have so changed that the new gun is intended to fire double the charge of the older piece, and the energy of its blow is expected to increase in almost the same proportion. We will explain how this has been accomplished. The 100-ton guns were made of coils of wrought iron, the inner tube only being of steel. The latter was made in two parts joined together, the junction being sealed by a so-called gas ring, as, at that date, there was a difficulty in procuring the long tube in one length of steel, and this was an undoubted weakness in the design. The new 110-ton gun is entirely of steel, and the inner tube is made in one piece by the firm of Sir J. Whitworth & Co., on the same principle as the propeller shafts for steamships.

A striking difference between the two designs is the proportion of the weight of projectile to that of the gun. In the 100-ton gun, with a projectile of 1,968 lb., the ratio is 1 to 113·8; while in the 110-ton gun, with a projectile of only 1,800 lb., the ratio is 1 to 137·5. We thus see that in the new system the projectile is lighter by some 17 per cent, in proportion to the weight of the gun, than in the older design. This change has been made in order to attain the present high muzzle velocity of over 2,000 ft. Since the effect of the blow, or the "energy" of a projectile—expressed mathematically by $\frac{Wv^2}{2g}$—depends directly on its weight, but varies with the *square* of the velocity, an increase of velocity is more important than an increase in weight. Thus, for example, suppose a projectile of 100 lb. moves at a velocity of 1,000 ft. per second, it will deliver a certain definite blow. If its weight is doubled the energy will be doubled, but if its velocity is doubled the energy will increase fourfold. Consequent on the reduction of the weight of the projectile, there is a reduction in caliber from 17·72 in. in the 100-ton gun to 16·25 in. in the 110-ton gun. The energy of the 100-ton gun projectile is 32,700 foot-tons. The greatest yet attained by that of the 110-ton gun was 53,895 foot-tons, but as much as 62,000 foot-tons is expected to be reached.

Some idea of the work or energy impressed on the shell may be given from the fact that the ship for which the new gun is intended, the Benbow, of 10,000 tons, could be raised upward 5·39 ft. if the same amount of work (53,895 foot-tons) were employed for that purpose; or we may, perhaps, give a better comparison by stating that the Benbow must steam at a speed of 10·5 miles an hour to inflict a blow with her ram having an energy equal to that attained by the projectile of the new gun. The disastrous and fearful effects of large vessels ramming at speed, when provided with strong bows, are well known. A considerable change has been made in the amount of capacity, on which depends the utilization of the effects of the combustion of the powder charge. In any gun, if the charge is increased, the energy of the projectile will not increase to the same extent, unless the interior capacity of the gun is also increased.

The projectile should not only receive pressure, but the pressure must act over a considerable distance. In other words, the greater number of times the compressed gas produced on explosion is allowed to expand in the bore, while at the same time it presses on the base of the projectile, the greater will be the energy imparted to the projectile. The same principles are involved as in the expansive working of steam. The greater the number of expansions allowed, whether in one, two, or three cylinders, the greater work will be performed by a given amount of steam under a given pressure. The object of the gun designer is, therefore, to increase the interior capacity of the piece as much as possible; but, as we have already seen that it is desirable to reduce the caliber, additional capacity must be obtained by increased length. The bore of the 100-ton gun is 363 in., while that of the 110-ton gun is 487·5 in. in length. An increase of capacity is also given by enlarging the diameter of the chamber or part allotted to the charge. In the 100-ton it is 19·7 in., while the bore is 17·72 in., but in the 110-ton gun this difference is much more pronounced, the figures being respectively 21·12 in. and 16·25 in.

It should be stated, however, that increase in the diameter of the chamber imposes a greater circumferential stress on the metal of the gun, for the same reason that water under pressure in a tube may burst it if the diameter is large, but it will not do so if the diameter is smaller, although the thickness of the metal is the same in each case. The strength of the new steel gun is, however, sufficient for the increased stress imposed by the enlargement of the powder chamber. The total capacities of the old and new gun are respectively 90,700 cub. in. and 112,600 cub. in., and we have dwelt at some length on this point, because of the importance of the principles involved. Four rounds have already been fired from the 110-ton gun, with charges of 600 lb., 700 lb., and 800 lb., on February 10, and 850 lb., on February 16.

Westphalian prism brown powder has been employed up to the present time, and the velocities attained have been satisfactory (from 1,685 ft. to 2,078 ft.). With the highest charge yet employed, the maximum pressure has been as much as 18¾ tons on the square inch. This, however, need cause no surprise. It merely indicates that a slower burning powder should be employed when very large charges are fired. As the volume of the powder chamber is a constant, it follows that when the charge is a small one a certain amount of "air space" is left. This serves to receive the initial expansion of the gases produced on explosion, and lowers the maximum destructive pressure, while, at the same time, some useful effect on the projectile is lost. On the other hand, when a large cartridge is employed, the air space is diminished, and the maximum pressure rises considerably. It is desirable that the pressure should never rise to a very high maximum, but that it should be well sustained. Hence it is possible that one description of powder might give good results when a small charge is used, but a slower burning powder might be employed with advantage when the charges are large.

We give herewith a longitudinal section of the gun, and diagrams in plan and elevation of H. M. S. Benbow, for which the 110-ton guns are intended. These show the method of barbette mounting. The central part only of the vessel is armored, and the ends of the vessel are protected by an armored deck below the water line. The four guns of 118 tons supplied by Krupp to the Italians are of crucible steel, the caliber (15·75 in.) being even smaller than that of our 110-ton guns.

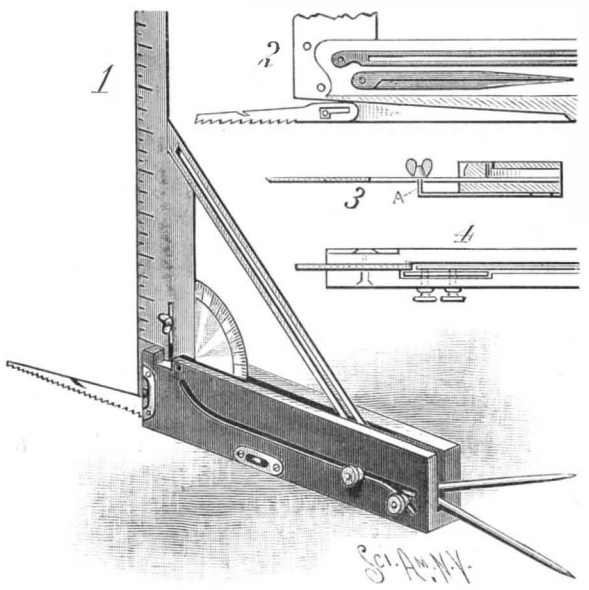
The greatest energy yet attained, of which we have information, is some 50,700 foot-tons, with 864·67 lb. of powder and a projectile of 2,028 lb., with a muzzle velocity of 1,900 ft. per second. It thus appears that although the Krupp gun is heavier than ours, and has employed a slightly larger charge than any yet fired in England, the muzzle energy attained by its projectile is somewhat less than that impressed upon the proof shot of the British gun.—*Industries.*

Carbonic Acid.

The manufacture of liquid carbonic acid is now an important industry in Berlin, where, according to *Industries*, a company established for this purpose are making daily over half a ton of this commodity. The acid is sent out in steel bottles, each containing from 17 pounds to 18 pounds, and the price charged is a little under 1s. per pound. The acid contained in a bottle when expanded into gas occupies over 10,000 cubic feet. It is principally used in the manufacture of mineral waters, and for beer engines. An important use of carbonic acid was suggested as early as 1879, by Dr. Raydt, of Hanover, for the raising of wrecks, who demonstrated the possibility of this application by an experiment at Kiel. The apparatus consisted of a steel bottle containing the liquid acid, and a collapsed canvas bag placed over the neck of the bottle. When the whole is submerged, and attached to the object to be raised, a cock is opened, and the liquid in the bottle is allowed to expand into the bag, inflating the latter, and thus causing it to rise. Another application was introduced by Herr Krupp, of Essen, for compressing liquid steel, and a large plant for the production of liquid carbonic acid has already been at work for some time at the Essen factory.

COMBINATION TOOL FOR SQUARING, LEVELING, ETC.

The engraving represents a tool which has been recently patented by Mr. David W. Warnock, of Lexington, Ky. The tool may be used for squaring, leveling, plumbing, centering cylinders, laying off angles, starting a saw kerf for cutting a keyhole, and for cutting lace leathers for belting. In one edge of the body is a groove, held in one end of which is a square blade which is cut away at an angle of 45° upon its inner edge, to form a beveled shoulder for receiving and supporting the end of a slotted bar, when in the position shown in Fig. 1. This bar is fitted in the slot, and is provided with a pivotal pin projecting through a second slot formed in the side of the body. This pin retains the bar in the body, while admitting of adjusting it in position for use or folding it into the body when not in use. The end of the second slot, near the blade, is curved toward the blade, and the opposite end is branched. In the main groove is placed a thin pair of compasses with a pivotal pin projecting through the side slot. When it is desired to use the slotted bar, the compasses are drawn forward into the branch of the side slot, and the pin of the bar is moved forward to the extremity of the slot beyond the branch, when the compasses may be pushed back entirely within the body. When the bar is folded over upon the shoulder, a left miter can be obtained; and when it is pushed



WARNOCK'S COMBINATION TOOL FOR SQUARING, LEVELING, ETC.

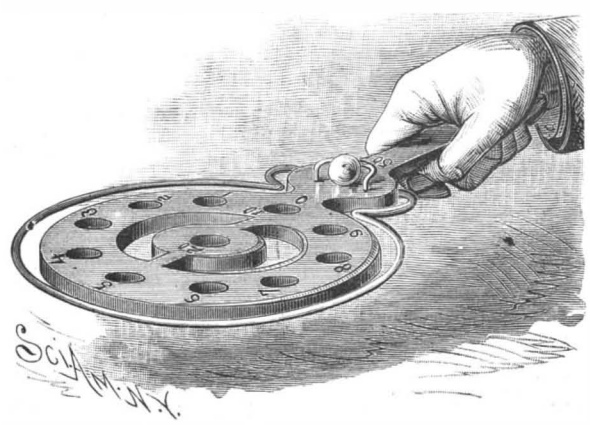
back in the slot to the angle of the body and blade, and then inclined outward at an angle of 45°, a right miter can be obtained.

Both right and left miters can be obtained without reversing or turning the square over. In the body is a cavity, into which the protractor may be turned when not in use. Fitting in a slot in the outer edge of the body is a keyhole saw, the inner end of which is slotted to receive a pin, as shown in Fig. 2. To facilitate the opening of the saw, its back is provided with a nick for receiving the thumb nail for lifting it out of its slot. In one side of the body, near the middle, and at one end, are secured spirit level bulbs, which are used for leveling and plumbing in the usual way.

In a transverse groove in one side of the body is a steel bar, A, Fig. 3, which is bent at right angles at its extremity toward the blade, and is formed into a knife having a shank projecting through a slot in the blade, to receive a nut for clamping the knife in any desired position in the slot. This knife is designed for cutting lace strings for belting, and is made adjustable, to admit of cutting laces of different widths. When not in use, the knife is moved into a notch in the edge of the body.

A NOVEL GAME BOARD.

This novel form of board is designed to be used in the playing of a game which not only affords much amusement, but requires considerable skill and steady nerves. The disk may be of any appropriate size, and is provided with a handle and formed with holes arranged and numbered as shown in the cut. To the enlarged portion of the handle is secured a bail, which acts as a support for the marble used in playing the game. Should the marble leave the disk, it would be prevented from



THE MARBLE PUZZLE OR NERVE TESTER.

falling to the floor by the encircling hoop. The main feature of the game is to cause the marble to pass from the bail around the disk, past the several holes, to and around the central hole, and back again to the bail. The marble should pass the holes marked with the lower numbers first, but if it should fall from the outer edge of the disk, or into either one of the two large inner openings, no count could be made. It is evident that the shape of the disk and the arrangement of the holes may be changed as desired.

This invention has been patented by Mr. C. E. Tranchell, of Willmar, Minn.

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Proprietors and Foremen.

A correspondent of *Wood and Iron* asks what he shall do under the following circumstance: He says that he is foreman of a certain shop, but that he is foreman only in name. The proprietor, who, he says, has no mechanical knowledge, continually interferes with the men, giving them orders contrary to his directions. He asks our advice as to whether he had "better quit or kick him out of the shop." We have been, says the editor, in precisely that situation ourselves, and we think on the whole he had better seek "pastures new." Where a proprietor of that kind interferes in the management of the shop at all, he will continue to do it, and the less he knows about mechanics, the more he will interfere.

A little incident in the life of the late President Rutter, of the Lake Shore Railroad, may not be out of place as illustrating the relative positions of proprietor and foreman. When Mr. Rutter first became general baggage agent for the Vanderbilt system, he came upon a very knotty problem, and not knowing what decision to give, he went to Vanderbilt for advice on the subject. When he had stated the case, Mr. Vanderbilt turned to him and asked: "What salary do we pay you?" "Eight thousand dollars a year." "What do we pay it to you for?" "For acting as general baggage agent." "Well, do you want me to earn your salary for you?" Mr. Rutter immediately came to a decision, and never again troubled Mr. Vanderbilt with his conundrums.

SCIENCE IN TOYS.

IX.

THE TOY MICROSCOPE.

The world of the minute existing beyond the range of the unaided vision is little realized by those who never have had an opportunity of using the microscope. The beauty and perfection of the smaller works of nature can never be fully known through the medium of literature or art; the objects themselves must be observed by the student personally.

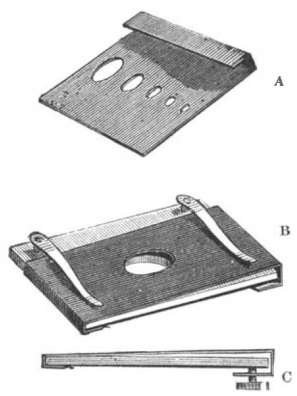

Fig. 2.—DIAPHRAGM AND FINE ADJUSTMENT.

In every pond and stream may be found microscopic forms of life. In every plant and flower, upon leaves and stalks, among the sands and rocks, almost everywhere in all seasons, may be found objects of absorbing interest to the student of microscopy. Animals and insects, food and manufactured articles, yield objects which may be examined microscopically with pleasure and profit. Chemistry and mineralogy afford attractive fields. In fact, one so inclined cannot fail of finding objects of interest with little difficulty.

Some have erroneously supposed an expensive instrument and elaborate accessories necessary to the pursuit of microscopical investigations. These things are, of course, desirable; but when one has learned all that can be learned by the aid of the simple and inexpensive microscope shown in the engravings, he is very far advanced, and may with propriety present his instrument to some one unable to purchase for himself, and proceed to the selection of something better suited to his advanced position in microscopy.

The microscope referred to was devised, at the suggestion of the writer, by one of our leading manufacturers. It costs six dollars and fifty cents, and although not as complete and convenient as more expensive instruments, it is more perfect and satisfactory than its predecessors of the same price.

It is 8 inches high, and has a draw-tube, which permits of extending it to a height of 11 inches. The foot and arm are of japanned iron. The tubes are well finished and lacquered. It has an objective divisible into two powers. The mirror may be swung over the stage for the illumination of opaque objects. The instrument has a neat cherry case, in which it may be placed when not in use

To the instrument as received from the manufacturer is applied a home-made diaphragm, as shown at A, in Fig. 2, and a fine adjustment, as shown at B, C, in the same figure. The diaphragm consists of a piece of perforated thin sheet metal, extending along the under surface of the stage and neatly bent over the outer edge of the stage, so as to be self-supporting—the perforations of the metal being respectively one-sixteenth, one-eighth, three-sixteenths, one-fourth, and five-sixteenths inch diameter, all arranged on a longitudinal line of the metal plate intersecting the axial line of the microscope tube, so that the centers of the holes of the diaphragm may be made to coincide with the center of the hole in the stage.

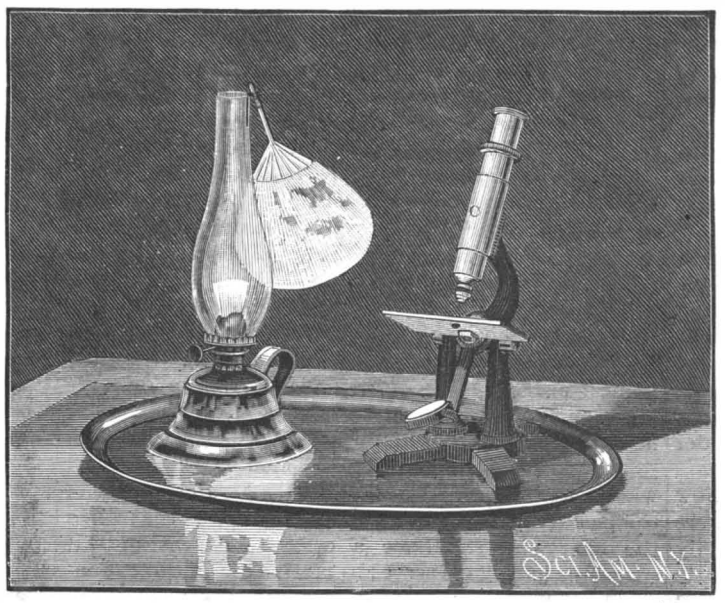

Fig. 3.—SUBSTITUTE FOR REVOLVING TABLE.

The attachment for fine adjustment is made by bending one end of a thin metal plate twice at right angles, so that it will spring on the side of the stage and clamp the stage tightly. The opposite end of the metal plate is bent in a similar manner, but the space between the body of the plate and the bent over end is made wider, to permit of a small amount of movement of this end of the plate. In the portion of this end of the plate extending under the stage is inserted a screw with a milled head, by means of which the free end of the plate may be made to move either up or down through a small distance. The body of the plate is inserted under the stage clips, and the object slide is inserted between the clips and the plate.

The instrument has no rack adjustment, but the main tube slides easily and smoothly in the guide tube, so that little or no difficulty is experienced in focusing. Besides the instrument and accessories, only the following articles will be required to begin in earnest the study of microscopic objects: A small pair of spring forceps, a bottle, a teaspoon, a few concaved glass slides, a few thin cover glasses, a glass drop tube, a small kerosene lamp: and if the investigator desires to entertain his friends microscopically, he will need a Japanese or tin tray, large enough to contain both microscope and lamp, as shown in Fig. 3, so that the relation of both may be preserved while the tray is moved to bring the instrument into position for different observers, by simply sliding the tray on the table.

A little caution as to illumination is necessary, as the beginner is generally unsparing of his eyes, using far too much light. A blue glass screen placed between the mirror and source of light, or between the mirror and the stage, modifies the light so as to greatly relieve the eyes.

The lamp should be provided with a shade of some sort to prevent the light from passing directly from the lamp to the eyes. A small Japanese fan suspended from the chimney by a wire, as shown, forms a very desirable shade.

Most objects viewed by transmitted light in an instrument of this class require an absolutely central light, that is, the light must be reflected straight upward through the object and through the tube.

When opaque objects are examined, the mirror is raised above the stage and made to concentrate the light on the object. Different angles of illumination should be tried, as some objects are greatly relieved by their shadows, while others require illumination as nearly vertical as possible.

Experience will soon indicate the right magnification for different objects. This may be varied by taking off or putting on the lower half of the objective, also by drawing out or pushing in the draw tube.

Various forms of apparatus have been devised for gathering objects from ponds and streams; but much can be done with no other aids than the spoon and bottle above mentioned. The mud at the bottom, scraped up with the spoon and placed in the bottle, will probably be found to contain microscopic life in abundance. The under surface of leaves of aquatic plants and of grasses hanging over into the water may be scraped with the spoon, and more or less of the matter adhering thereto will be secured. Occasionally a long leaf like that of the flag may be lifted from the water and traversed by the spoon with good results. Small twigs and dead leaves floating in the water are often found teeming with life. The thousands of animalcules and forms of minute plant life found in water will afford the most zealous student a life-long supply of subjects for examination.

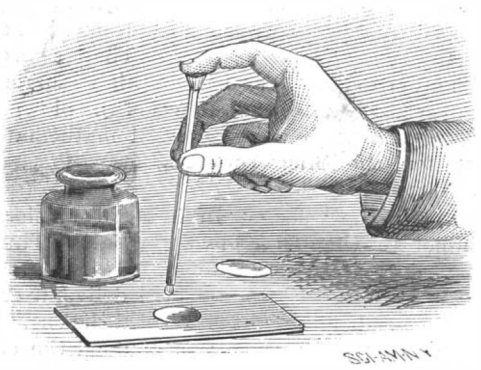

Fig. 4.—TRANSFERRING OBJECTS TO THE SLIDE.

The objects are transferred from the bottle to the concavity of the slide for examination in the manner shown in Fig. 4. The drop tube, which has a funnel-shaped top, is stopped by the finger at the upper end, while its lower end is inserted in the water in the bottle above the matter to be removed. The finger is then removed and some of the water, together with the objects carried by it, rushes upward into the tube. While the lower end of the tube is still in the water, the finger is again placed on the tube and the tube is withdrawn from the bottle and held over the cavity of the slide, as shown in the engraving, when a drop or so of the water is forced out by pressing down the end of the finger on the top of the tube; the soft end of the finger acting as a sort of diaphragm in forcing out the required amount of water. Care must be taken to avoid getting solid matter upon the slide around the edge of the cavity, as it will prevent the cover glass from seating itself properly. The cover glass is placed over the cavity and pressed down lightly to squeeze out the surplus water, when the slide may be inserted under the clips of the stage and examined.

It would be futile, in a paper like this, to attempt anything more than the mere mention of a few of the interesting objects that may be seen to advantage in a small microscope. In Fig. 5 the engraver has beautifully shown some of the common objects which are easily secured, readily examined, and always interesting. At 1 in this engraving are shown various seeds; the lace-covered one at the top being the seed of the *Nemesia compacta*. The seed in the center is that of heather. That on the right of the lace-covered one is the seed of the poppy. The fringed one below it is that of the climber. At the bottom of the disk the seed of sorrel is shown at the left, and portu-

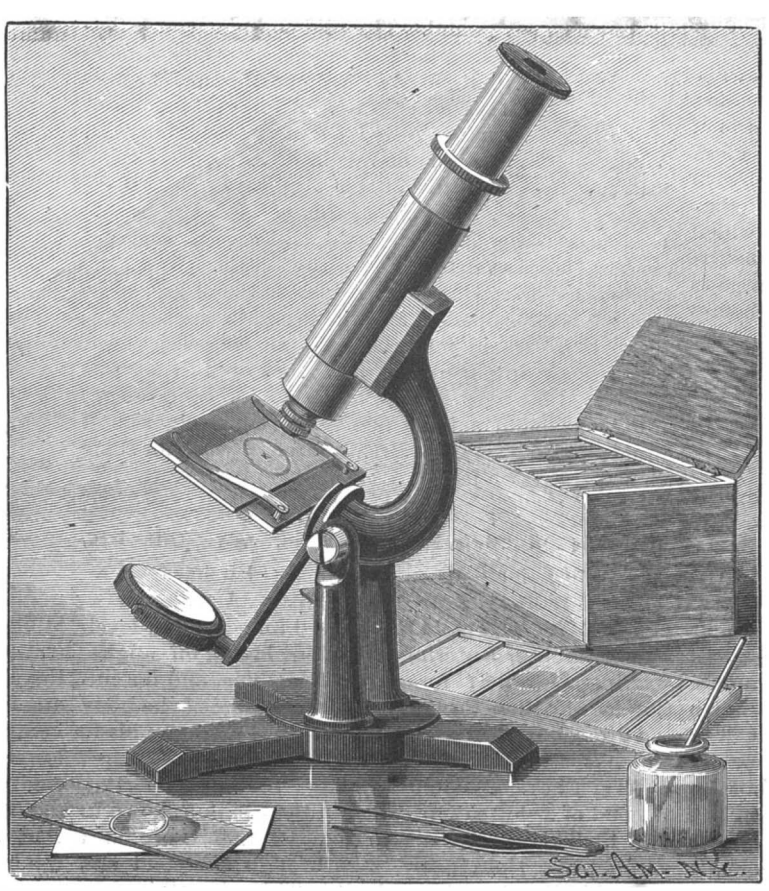

Fig. 1.—THE TOY MICROSCOPE.

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lacca at the right. The remaining seed at the left is that of eucharidium.

2 represents the proboscis of the blowfly as it appears in the field of the microscope, except that the intricate structure of the pseudo-trachea is not shown in the cut as it appears in the microscope.

3 shows the doubling hooks of a bee's wing, which enable the insect to connect the wings of each pair so that they may be used as a single wing.

4 shows the silicious stellate hairs on the back of a deutzia leaf. The upper half of 5 shows several forms of diatoms, and the lower half is filled with desmids.

In 6 branchipus is shown at the top, cyclops at the left, a young cyclops at the bottom, and daphnia or the water flea at the right. These are common in almost every pond.

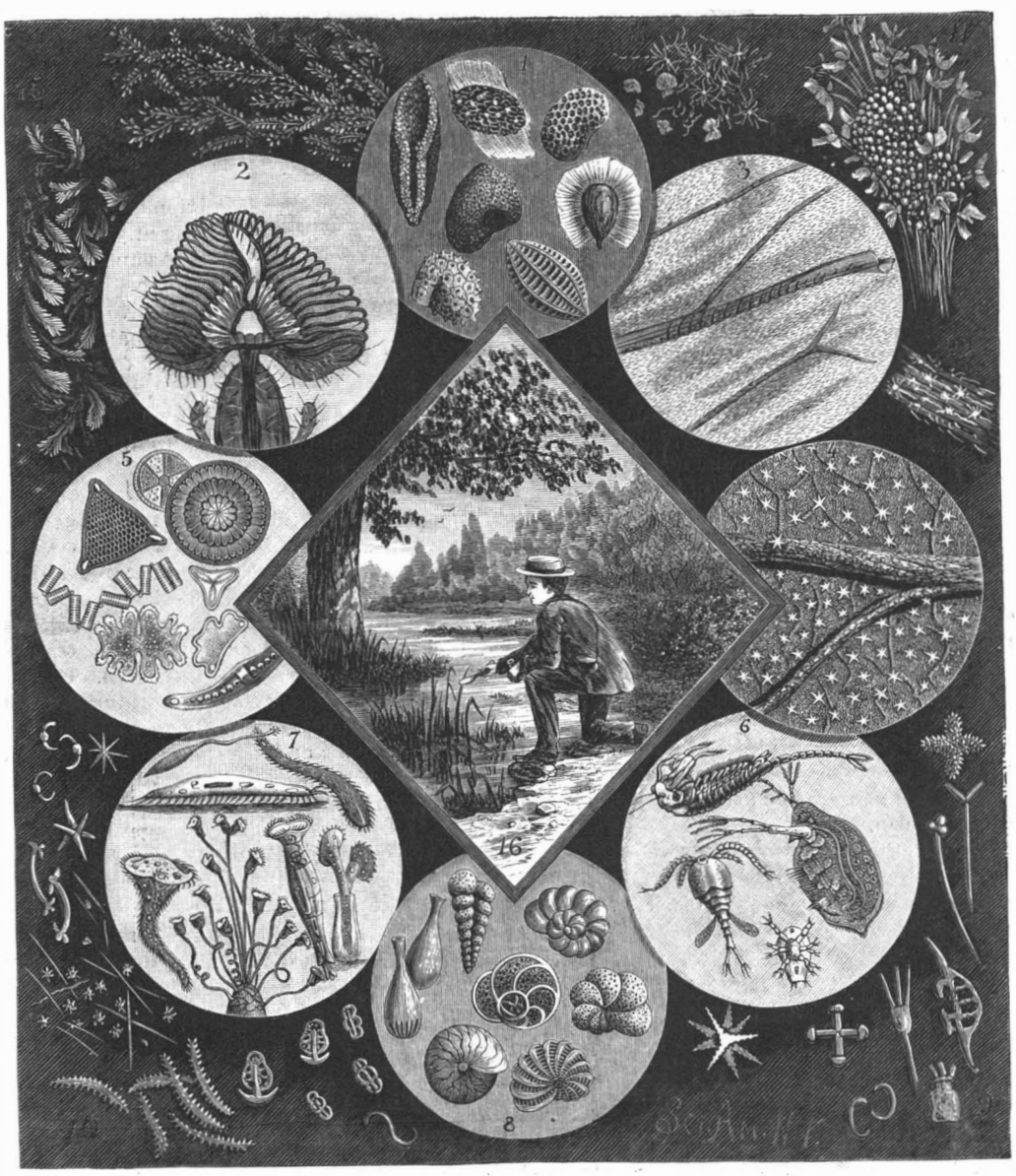
In disk 7 are shown on the left the stentor, so named on account of its trumpet-like form; in the center the beautiful and sensitive vorticella, and upon the right of the vorticella common rotifer, and upon the extreme right the sheathed trumpet animalcule. All of these have cilia around their margins, which by their peculiar vibratory motion give the bell-shaped mouths the appearance of rotation. In the common rotifer, and in the animals shown in disk 6, the internal organs may be readily seen in operation.

In the upper part of disk 7 are shown a few of the hundreds of forms of life found in water in which animal or vegetable matter has been infused.

In disk 8 are represented a number of the exquisite little shells of foraminifera. At 9 are shown various spicules of sponges, sea urchins, etc. At 10 are shown sponge spicules and the anchor of *Synapta inherens*. 11 shows the pollen of marsh mallow, and 12 and 13 are examples of plant hairs. 14 shows arborescent crystals of silver, and 15 the fern-like crystals of gold.

The following books are recommended to the beginner in microscopy: Wood's "Common Objects for the Microscope;" "One Thousand Objects for the Microscope," by M. C. Cooke; "Evenings at the Microscope," by Gosse; and "Practical Microscopy," by George L. Davis.

G. M. H.



1. Seeds. 2. Tongue of Fly. 3. Bee's Wing. 4. Deutzia Leaf. 5. Diatoms and Desmids. 6. Entomostraca. 7. Infusoria, Rotatoria. 8. Foraminifera. 9. Spicules. 10. Spicules and Plates. 11. Pollen of Marsh Mallow. 12. Plant Hairs. 13. Shepardia Canadensis. 14. Crystals of Silver. 15. Fern Gold. 16. Gathering Objects.

Fig. 5.—VARIOUS MICROSCOPIC OBJECTS.

Hemp Cultivation in Yucatan.

The cultivation of hemp (heniquen) is the principal agricultural industry of Yucatan, and of this the greater portion is imported into and consumed in the United States, the imports thereof during the year 1885 amounting to 36,401 tons, valued at $2,564,000. We are, therefore, largely interested in this industry, which is carried on in a very primitive manner. The plant, says Consul Thompson, to whom we are indebted for the following facts relative to its cultivation, is a species of agave. It is best propagated by cuttings, the young plants being allowed to grow at will until three years old, after which they are transplanted into regular rows and fields. Eight years are given them to mature into plants able to bear the cutting, and then the result of these years of patient waiting will continue to flow uninterruptedly for many years if moderate care be exercised. The leaves are cut by a peculiar instrument, a cross between a sickle and a carving knife, called by the natives corba, and are made into a systematic bundle of about 25 each, and carried by the laborers upon their backs to the tram car or cleaning wheel, where they are passed through the process before mentioned. This cleaning wheel is the only kind of agricultural machine, as we understand the term, in use upon the farms of Yucatan. Even the plow is practically unknown. Each mecate of hemp land should produce yearly four arrobas of merchantable hemp. Arroba is the equivalent of 25 lb., therefore each acre, or 10 mecates, should yield at least 1,000 lb. of heniquen fiber ready for shipment.

To cut and pack 1,500 leaves is considered to be an ordinary day's work. These 1,500 leaves, when cleaned and dried, will produce about 3 arrobas, or 75 lb., of fiber. One cleaning wheel with two men to tend it is calculated to clean easily 7,000 leaves per day. A 400 lb. bale of fiber—cut off from the plant, but still in the leaf—is estimated to cost $4, or 1c. a pound; when cleaned, bleached, and baled ready for shipment, the cost is probably a small fraction over 2c. per pound. A hemp plantation containing 10,000 mecates, or 1,000 acres, should produce annually 1,000,000 lb. of merchantable hemp.

Heniquen fiber is the principal article of export from Yucatan to the United States. During the fiscal year ending June 30, 1884, there was exported from Progreso, Yucatan's port of entry, heniquen fiber having a value of over $2,500,000, American gold. During the calendar year of 1884, the amount of hemp shipped to all parts from Yucatan reached the figures of 233,311 bales, averaging 400 lb. per bale. The value of the above, expressed in Mexican dollars, is $3,334,609. In American coin the value is expressed at $3,045,304. The duties and taxes of state and national governments amount to the sum of $137,000, Mexican money. Over six-sevenths of the above exportation went to the various ports of the United States, New York leading with 187,978 bales.

A scourge of locusts harasses poor Yucatan, and under this bane all agriculture, save the single product hemp, droops. Fields of maize are planted and thrive for a while, only to be devoured level with the ground in one short hour by a host of the pests. The heniquen plant for some reason seems to be let severely alone by them. This is providential, and enables the planter, by selling his fiber, to obtain from the United States the grain that the locusts deprive him of the power to raise at home.

Picrate of Ammonia in Malarial Diseases.

Dr. H. Martyn Clark, of the Amritsar Medical Mission, Punjaub, has treated no less than 10,000 cases of malarial diseases with picrate of ammonia, and in half the cases he has kept a record. In nine cases out of 5,000 did the picrate fail, and in these quinine cured at once. The usual dose is from ⅛ grain to 1½ grains four or five times a day in pill. Half a grain is a fair average dose. Thus given the result is soon visible. In the great majority of the cases treated, ½ grain doses in the interval prevented the recurrence of the next attack of the fever, while in about 20 per cent of the patients two or three attacks followed before the fever ceased. In only one case of quartan ague, despite large doses of the salt, the fever recurred for six periods, gradually diminishing in intensity, and then yielded to it. It is equally successful in all the forms of ague, but it is a curious fact that the cases in which it failed to cure were all of the tertian variety. Dr. Clark has also employed this agent in the treatment of twenty-five cases of malarial neuralgia of various nerves, six cases of malarial headache, and one of malarial colic. In all these instances it cured completely and speedily. In addition to being cheaper and given in smaller doses, picrate of ammonia does not produce the unpleasant effects that quinine does, such as headache, deafness, tinnitus, etc.; nor does it, like quinine, disorder the digestion or cause nausea, as quinine does in India.

A Spontaneous Effusion.

Brick Pomeroy's *Democrat* has a high appreciation of this paper, as the reader will conclude when he reads the following unsolicited editorial notice, taken from a recent issue of the *Democrat:*

The SCIENTIFIC AMERICAN is in fact what the Bartholdi statue is in theory—the giver of light and conveniences to the world. It has encouraged and stimulated the inventive genius of the country, and thus helped to develop thousands of ideas that are now positive facts and most useful blessings to humanity and great helps to progression. Year after year it has opened the door for new thoughts to enter. Never has it joined in the senseless, deadening yawp of over-production. On the contrary, it has ever urged the bringing forth of the new, the multiplying of devices and inventions, and the making and giving of employment to millions in this country who to-day are engaged in useful avocations that were unknown when the writer of this was a boy. The world moves, and more of the credit than people think for is due to the SCIENTIFIC AMERICAN and its help to make Americans scientific. It is published by Munn & Co., 361 Broadway, New York, at $3 a year. The SCIENTIFIC AMERICAN SUPPLEMENT, 16 pages, weekly, $5 a year. The two, $7 a year. It is no uncommon thing for one number of either to benefit the subscriber more than ten times the yearly subscription for both publications, especially if he has a brain for machinery and a desire to lead on from one thing to another.

The Variable Star Algol.

Estimating the distance of Algol from the ascertained distance of the few stars which are near enough to have had their parallax accurately measured, it would take light not less than thirty years to reach the earth. We see Algol, not as it is to-day, but as it was thirty years ago. When we see its brightness dimmed, the phenomenon which we are observing is one which actually occurred thirty years ago, the light which left the star at that time having just reached our eyes. During those thirty years the image of that phenomenon, if I may so express it, has been on its rapid way toward us. But less than three days after it started, when it had just commenced its journey, having come only fifty thousand million miles on its way, another period elapsed, another partial obscuration took place, and the image of that started on its hitherward course. This was followed, three days later, by another, 50,000,000,000 miles behind it; and that by another, and another; and thus, during the whole period of thirty years, the life of a generation, these successive images have been winging their way toward us. There are 127 of these periods in a year, and nearly 4,000 in thirty years. When, therefore, we see the obscuration of Algol, we know that 4,000 such obscurations have taken place since the one we are observing, the images of which are following each other at invervals of 50,000,000,000 miles along the vast space which separates us from that wonderful star.—*Henry M. Parkhurst.*

AMONG the numerous collectors of curiosities of every kind who abound in Paris, there is one wealthy virtuoso, according to the *Pottery Gazette*, who amuses himself by collecting deaths' heads and skeletons fantastically carved or modeled in marble, earthenware, wood, or precious stones. These he has gathered together in a kind of museum of death, which at first sight seems hideous and *macabre*, but on closer inspection proves highly interesting. Some of the heads have been detached from those old mediæval rosary beads which were usually ornamented on one side with the profile of a king or a saint, and on the other with the grinning face of a skeleton.

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Uncle Sam's Curiosity Shop.

It may not be known to many out-of-town readers of the SCIENTIFIC AMERICAN that the United States court in which patent cases are tried in this city is held in the Post Office building.

It is necessary to know this fact to understand what impelled a newspaper reporter to climb so high to find the miscellaneous articles he describes.

"Climbing flight after flight of stairs in the Post Office building, by an inside passage, until there was nothing between him and the sky except the roof, an *Evening Sun* reporter, very much out of breath, reached at last the curiosity shop of Uncle Sam. Two large rooms and a small one are devoted to the curiosities. They are piled up on the floor in great heaps, while tiers of long, broad shelves are filled with them. There are so many of them that the custodians would very much like to get rid of them. But they are preserved with jealous care. They are the exhibits made by contesting parties in patent cases. The testimony is taken on the floors below in the offices of the United States Commissioners, and the exhibits, after being properly marked for identification by the examiner, are stowed away.

"It needs but a cursory glance to come to the conclusion that nearly everything that man uses is patented, and that nearly everything that is patented has to fight infringements, or at least what are claimed to be infringements.

"Bundles of cloaks, corsets, hats, ready-made clothing, and hat sweats are piled up on the middle shelves. Hoopskirts, frames used for clothing in shop windows, fire screens, patent medicines, and paints add variety to the scene. The 'shoo-fly' rocker is largely represented, made in the shape of a bird.

"The floor of the smaller room is completely covered with a pile of school furniture. High up on the wall hangs a model of a sliding car door. Near it are several sets of heavy iron shutters. Huge furnaces rest by the side of tiny oil stoves.

"The veteran exhibit is a specimen of the first refrigerator invented. It consists of a barrel within a barrel, the spaces between the inner and outer one being filled with brick. The inner barrel is divided by a partition, one side being intended for the ice and the other for the storage of the articles to be preserved. An equally curious exhibit is the model to show how wet tan is burned. It is made of tin, and consists of a large number of curiously arranged boxes.

"There is a full collection of railroad signals, with white and red headlights. One of the towers is a leaning tower. Near by is a set of electric bells, a patent bottle stopper, a hopper, a cotton press model, and a great variety and number of scuttles. Patent pails are equally numerous, and there is a large assortment of tin oil cans. A very odd spring has a triangular base, with a straight rod working up and down.

"Among the most profitable inventions is the nail driver and puller. Another is the patent egg box, with its numerous compartments, made with straw boards. Photograph instruments, bed springs, and odd wagon springs rest side by side. Several yellow bags, curiously tied, arrest the attention. These are intended to show how hams are tied up. The style of tying is patented. Patent cuspidors occupy an upper shelf. Just under them are a number of coffee mills.

"There is a very interesting bit of machinery for making barrels and hooping and heading them. On the shelf above it is an equally curious exhibit of a brick machine. Two very clumsy and heavy exhibits are the models of a machine for making boot heels, and another for manufacturing envelopes. The latter is old-fashioned and very complicated. Two other clumsy exhibits are the knitting and ruffling machines, and also one for pegging.

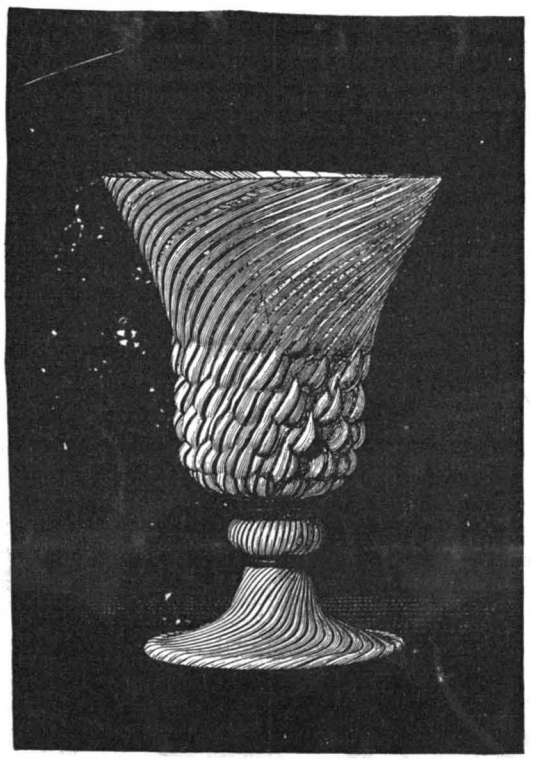
"Soda fountains are very numerous, and there are buttonhole and kid glove machines, with countless sewing machines, whole and in parts. Only a small fraction of the entire collection has been named. It is apparent that in the matter of a patent, eternal vigilance is the price of success."

Exhibition of Locks and Keys.

An Austrian locksmith, Herr Andreas Dillinger, has been for eighteen years collecting locks and keys of ancient and modern manufacture. The work was undertaken with a view to benefit the locksmith trade, by diffusing useful knowledge, and the articles were first exhibited two years ago, in an industrial museum at Vienna. On the initiative of the Educational Department of the Austrian Ministry, the collection was sent for exhibition into various towns in Austria, and after the round was completed Herr Dillinger carried his collection to Germany, and exhibited it there in various important industrial centers, the last in turn being Berlin, where the collection has recently been on view. It contains 606 different locks, the earliest examples dating from the year 400, and the latest being quite modern. Among the collection are seventeen locks from the middle ages, which, in point of workmanship and artistic design show the high state to which this industry was developed in those times.—*Industries.*

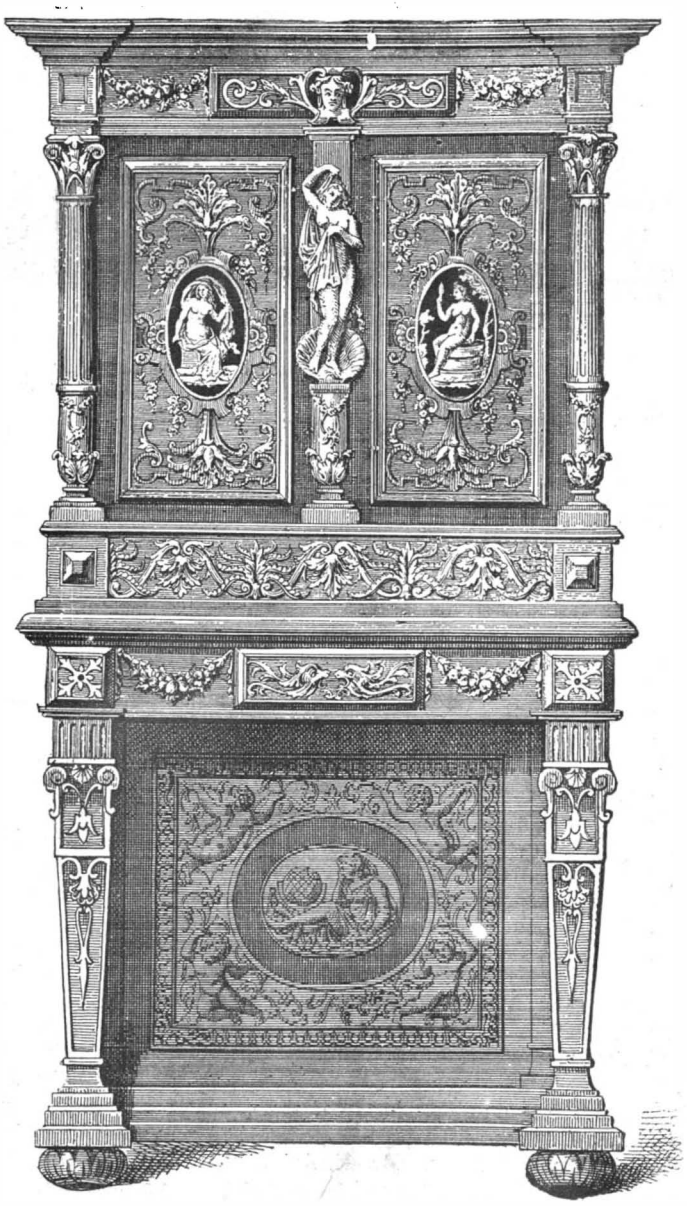
THE DECORATION OF A HOME.

In the "Grammar of the Decorative Arts," by Prof. Charles Blanc, of the College of France, and a member of the Academy, the author tells us that "effects of



VENETIAN GLASS—SEVENTEENTH CENTURY.

perspective are absolutely forbidden in the decoration of the floor," and that "in furniture the straight lines should be mainly vertical and the curved lines mainly horizontal in direction." In the beautiful cabinet of which we give an illustration, though the vertical lines are partially destroyed, enough of them remains to give a sense of stability. The top has no pediment, but is terminated with a straight line, affording a shelf on which vases, busts, or other beautiful things may rest. The pillars are carved and channeled and cut away, and yet do not suggest want of strength, because their burden cannot be great. The elaborate carving on the whole front is very rich, and suggests that a cabinet of such workmanship would be a worthy repository of precious trophies as well as serve its other and ostensible purpose of decorating an apartment.



FRENCH CABINET—SEVENTEENTH CENTURY.

The seventeenth century glass shown in our illustration is the product of the period at which Venetian art is considered to have reached its highest point. The workmen of that period attained extraordinary facility in twisting and drawing out the ductile mass into the most elaborate forms, intertwining and working together stems and wreaths of various colors. The points of support were usually very slender, and these objects were consequently so fragile that comparatively few of them have come down to us.

Although Venice, from the twelfth to the fifteenth centuries, introduced the glass manufacture to France, Germany, England, and other countries, and for a long period maintained an undeniable leadership in this industry, she has obtained no especial distinction therein since the latter part of the last century. Nearly every general industrial exhibition continues to have brilliant examples of the products of the Venice and Murano Glass Company, but the company is composed chiefly of English capitalists, and glass beads constitute probably the larger part of the Venetian glass manufacture to-day.

Do Something.

A man who kept quite a number of men employed in different ways, so that largely they could not be under his immediate control, complains, in the *Industrial Gazette*, that the worst trouble he had was to secure men upon whom he could rely to do something. He would tell them plain enough what he wanted, and then start them out. If anything should turn up different from what they had expected, the larger proportion of his men would come back without accomplishing anything.

As an illustration, he had a man with a team handling bridge lumber quite a distance from one of his saw mills to a railroad shipping point. By securing a reasonably early start, the team could make a good load every day. One afternoon, as he was returning with a load, and had got perhaps half way home, in coming down a hill, through a strip of timber, one of the hind wheels struck a stump and, by some means, broke the axle of the wagon. The man always carried an ax and an extra chain or two, especially to guard against accidents. He was in timber where, with very little trouble, he could have arranged something that would have enabled him to have taken his load into town. He might have been a little longer than usual. Instead of this, he pulled his load to one side of the road, unhitched his team, and mounting one of the horses, rode into town. His employer did not happen to be at home, so nothing was done until the next morning, when he borrowed another wagon and went out and brought in the lumber, and then, leaving the wagon, rode out, rigged a pole under the broken axle, and brought the wagon to town to the shop. Another day was lost in getting the wagon repaired. At least a full day lost more than was necessary, simply because he could not see that it was his business to do something. "I could," he said, "have stood a heavier loss with better grace if the man had only tried to do something rather than spend his time doing nothing. He could at least have shown a disposition to do the best he could. There are plenty of men who see a thing, routine work, done every day, and yet if they were told to do the same thing, would ask to be shown how. They learn nothing from observation. They may see lumber piled up every day, or see and even help put up machinery, load a car with certain material; yet ask one of them to go ahead and do by themselves just what they have been helping do, and they will want to be shown how. They are either incapable or indifferent of learning by observation, or even helping. With some this is simply the result of thoughtlessness. They do not stop to think that they are failing to work as they should to their employers' interests. With others, it is simply indifference. So the day's work, or time rather, is put in; it is a small matter whether the work accomplished is in any way profitable to the employer or not.

A great many employers will recognize their own experience with indifferent, thoughtless employes in the above well told story from our excellent Western contemporary.

A Curious Clock.

A correspondent in *The New Church Messenger* describes a clock recently patented in France, in imitation of a tambourine, on the parchment head of which is painted a circle of flowers, corresponding to the hour figures of ordinary dials. On examination, two bees, one large and the other small, are discovered crawling among the flowers. The small bee runs rapidly from one flower to another, completing the circle in an hour, while the large one takes twelve hours to finish the circuit. The parchment surface is unbroken, and the bees simply laid upon it, but two magnets, connected with the clockwork inside the tambourine, move just under the membrane, and the insects, which are of iron, follow them.

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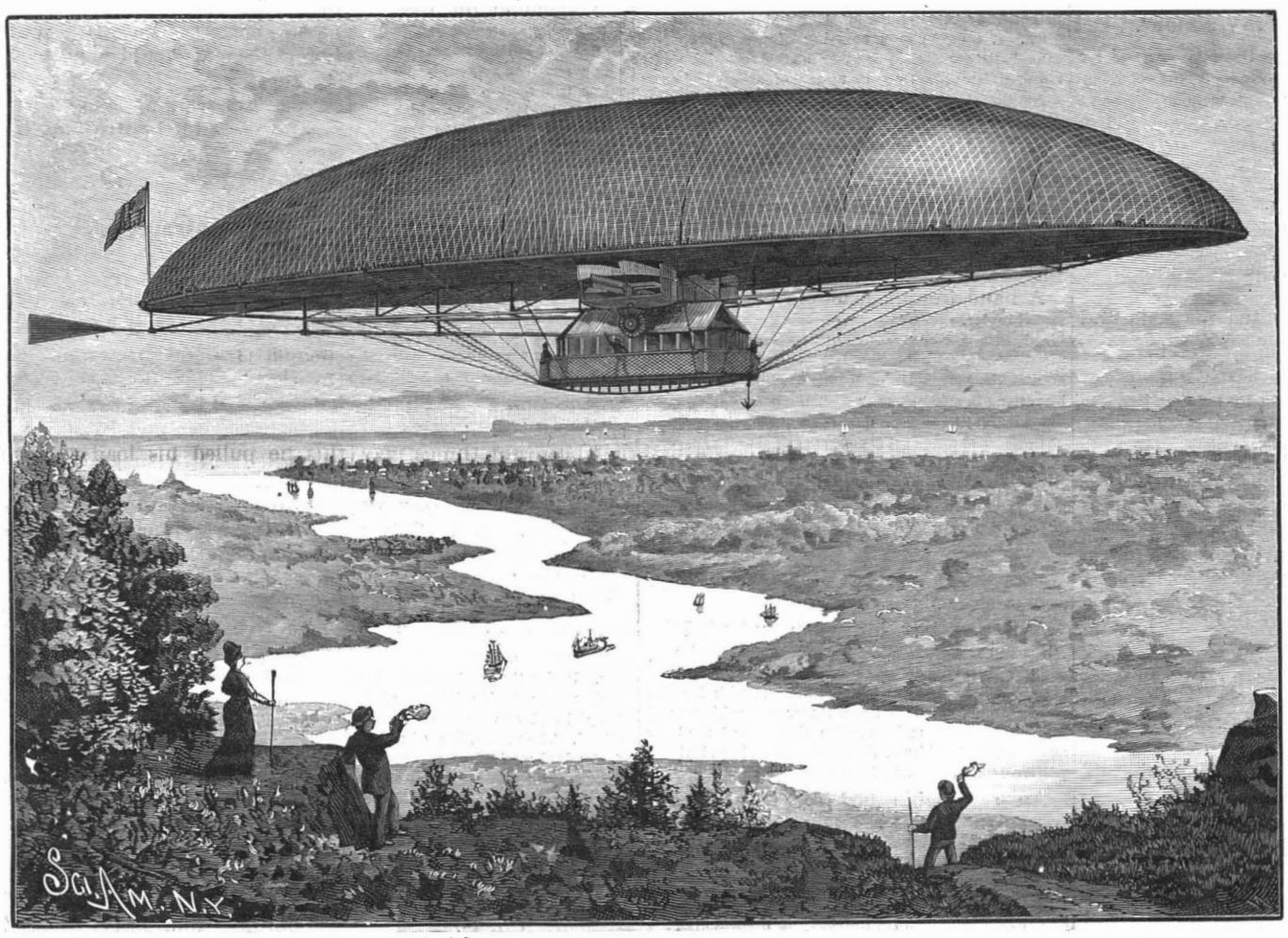
BRAUN'S ELECTRO-DYNAMIC AIR SHIP.

The balloon of this air ship is in the form of half a cigar, presenting a flat under side, and made with a number of independent gas cells, seven of these cells being represented in the view given in our illustration; but these cells are again divided longitudinally with the axis of the ship, thus making fourteen separate compartments in all. The base and contiguous faces of the cells or chambers are straight, their exterior being curved to conform to the desired shape of the balloon, and the walls of the cells may be made of silk or other fabric impervious to air, or they may be made of thin sheets of aluminum. These cells or chambers are surrounded and held together by a netting or covering, making a sectional gas holder, whose bottom is supported upon a framework with horizontal cross pieces, resting in the middle upon a grate-like keel, a binding wire or rope passing around the outer edge, connecting the ends of the horizontal cross pieces, and holding the netting or covering in place. The boat or cabin is suspended from this framework, and from it the elevating, propelling, and steering apparatus is controlled. The cabin carries a battery for the motors, a windlass with cable and grappling hook, compass, electric lamp for night work, instantaneous photographic apparatus, and other conveniences.

The controlling idea in this construction is to have the balloon comparatively small, so that the whole apparatus, when the gas cells are filled, will be about the ordinary weight of air, the ascensional and propelling power to be obtained from an electric motor of any approved form, one of two horse capacity being deemed to have ample power to make a practically operative air ship according to this invention. The elevating and propelling mechanism consists of two horizontally revolving wheels, operated from the main shaft mounted in the car, each wheel being an air screw or an elevator and a propeller combined, the air screw being directly above the propeller, which is designed to act upon the air like the wing of a bird, regulating also the course of the ship to right or left, by means of a hand wheel under the control of the aeronaut in the cabin, whereby also the vanes or blades of the propeller screw may be readily changed to different inclinations. The rudder is operated by a tubular steering rod, supported within the car by a stationary bracket, and having a hand lever, whereby the rudder is adapted to be rotated about its longitudinal axis and be deflected laterally to the axis. In order to compensate for the weight of the occupants, and keep the vessel in a horizontal position, a shifting weight is employed, adapted to run on wire ropes or tracks, the weight being attached to and moved by an endless band; this weight under the framework forward and the rudder at the stern both being made to act as balances, and under control by the aeronaut from a common standpoint in the cabin.

This invention has been patented by Dr. Martin Braun, of Cape Vincent, N. Y.



BRAUN'S ELECTRO-DYNAMIC AIR SHIP.

Determination of High Temperatures.

M. Walrand, a civil engineer, has invented the following highly practical process for determining the temperature of metallurgical furnaces. It has already been applied to a Siemens-Martin furnace, but the principle is equally applicable to other systems of furnaces. It is based on the observations of the oscillations of a seconds pendulum, hung against the wall of the furnace near the furnace tender. It is a simple rod, with suspending eye at one end and screw at the other, for holding and adjusting its bob. It is first regulated by a reliable watch, so as to beat seconds. When the operative wishes to know the temperature of his furnace, he introduces a bar of iron into it by a suitable opening. This bar is made of iron 8 millimeters (one-third inch) in diameter, and is kept 21 seconds in the furnace, according to the pendulum, which is started swinging. It is then withdrawn, and if it has attained a welding heat, that is to say, if it throws out sparks as it is withdrawn, the furnace is hot enough. This method, of course, gives no absolute temperature, but it is accurate enough for practical needs.

Plaster for Interior Work.

The mortars used for inside plasterings are termed coarse, fine, gauge, or hard finish, and stucco. *Coarse Stuff.*—Common lime mortar, as made for brick masonry, with a small quantity of hair, or by volumes, lime paste (30 pound lime) 1 part, sand 2 to 2¼ parts, hair ⅛ part. When full time for hardening cannot be allowed, substitute from 15 to 20 per cent of the lime by an equal proportion of hydraulic cement. For the second or "brown coat" the proportion of hair may be slightly diminished. *Fine Stuff* (*Lime Putty*).—Lump lime slaked to a paste with a moderate quantity of water, afterward diluted to the consistency of cream, and then allowed to harden by evaporation to the required consistency for working. In this state it is used for a "slipped coat," and when mixed with sand or plaster of Paris, it is used for the "finishing coat." *Gauge Stuff*, or hard finish, is composed of from three to four volumes fine stuff and one volume plaster Paris, in proportions regulated by the degree of rapidity required in hardening; for cornices, etc., the proportions are equal volumes of each, fine stuff and plaster. *Stucco* is composed of from three to four volumes of white sand to one volume of fine stuff or lime putty. *Scratch Coat.*—The first of three coats when laid upon laths, and is from ¼ to ⅜ of an inch in thickness. *One coat work* is plastering in one coat without finish, either on masonry or laths—that is, rendered or laid. *Two coat work* is plastering in two coats, done either in a laying coat and set or in a screed coat and set. The screed coat is also termed a floated coat. Laying the first coat in two coat work is resorted to in common work, instead of screeding, when the finished surface is not required to be exact to a straight edge. It is laid in a coat of about half an inch in thickness. Except for very common work, the laying coat should be hand floated. The firmness and tenacity of plastering is very considerably increased by hand floating. *Screeds* are strips of mortar 6 to 8 inches in width, and of the required thickness of the first coat, applied to the angles of a room or edge of a wall, and parallelly at intervals of 3 to 5 feet all over the surface to be covered. When these have become sufficiently hard to withstand the pressure of a straight edge, the interspaces between the screeds should be "filled out" flush with them, so as to produce a continuous and straight, even surface. *Slipped coat* is the smoothing off of a brown coat with a small quantity of lime putty, mixed with 3 per cent of white sand, so as to make a comparatively even surface. This finish answers when the surface is to be finished in distemper or paper hangings. *Hard finish* is fine stuff applied with a trowel to the depth of about one-eighth of an inch.—*C. H. Haswell, in the Architect* (*London*).

Electric Bleaching.

At a recent meeting of the Society of Chemical Industry, a paper by Messrs. Cross and Bevan was read on "Hermite's System of Electrolytic Bleaching." The authors stated that in ordinary bleaching the bleaching powder added to water gives hypochlorite of lime, which acts upon organic compounds by oxidation. Sometimes, however, oxychlorination takes place. In these actions chlorine may be regarded as an accumulator of oxygen. Other suitable oxygen yielding substances are permanganate of potash and hydrogen peroxide, but of the three, bleaching powder is the most economical.

M. Hermite's new source of supply of bleaching compounds consists of the electrolysis of the chlorides of the alkalies and alkaline earths, preferably the latter, and of these chloride of magnesium gives the best results. The whole energy of the current may be utilized when the hydrogen given off in the process is collected and burnt. There is evidence, however, of a retention of a portion of the hydrogen. In the electrolysis of magnesium chloride there are great chemical complications, and the bleaching efficiency of the resulting solution is in excess of that of the chlorine produced, as calculated by the electrolytic law. Its efficiency is also greater than that of a solution containing bleaching powder, although it may be argued that there are theoretical grounds for believing this to be impossible. Time affects the results in bleaching operations, and rapidity of first attack is advantageous, one of the results being a small consumption of bleaching oxygen as compared with that used up from ordinary bleaching solution. Mr. Cross illustrated this by placing some linen yarn in a solution of bleaching powder, and some more yarn in the liquid produced by electrolysis. The action of the latter was the more rapid of the two. Chlorine, the authors said, can be turned out by Hermite's process at the rate of 100 kilo. per hour, with the consumption of 570 horse power. The authors found that in producing what is known as "the three-quarter bleach" with flax, the electrolytic chlorine, as it may be called, has twice the efficiency of the chlorine of bleaching powder. In this comparison they used the word "chlorine" for convenience. On account of the efficiency just stated, one or more of the usual alkaline treatments of the yarn may be suppressed.

Paper pulps had been bleached by the authors with economy. The bleaching efficiency of the electrolytic chlorine, or rather oxygen, is to that of bleaching powder as 5 : 3. This ratio is also the mean of a large number of determinations on the vegetable substances of various kinds used in textile and paper manufactures. The e.m.f. of the current being taken at 5 volts, the ratio of chemical effect to the power is 1·47 grm. bleaching chlorine for 5 watts. From this fundamental equation, the economy of the system is directly deducible, taking the cost of 1 horse power at £9 per annum, and the effective yield of one h. p. at 600 watts. Taking also the cost of the unit electrolytic installation, *i. e.*, for a current of 1,000 amperes, at 5 volts, at £350 (the electrodes being plantinum and zinc), the costs on one ton of the hypothetical bleaching powder are: For mechanical power, £1 10s.; for the electrolysis (interest and depreciation at 15 per cent), £1; for waste of salt, etc., 10s.; total, £3.

W. McC. writes: I noticed the following question asked by B. T. R. in your journal, under date of 19th March, 1887: "Why is stale bread considered more wholesome than new?" Fresh bread is not allowed in the British army. It must be at least twelve hours old before using. Could not Canadians and Americans learn a useful lesson from the custom in the British army? Experience only solves the question.

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ENGINEERING INVENTIONS.

An electric railway signal has been patented by Mr. Joseph McMasters Scott, of Allegheny, Pa. The invention consists of an electric circuit connecting the central office and the signal box, and of a signal block, which when moved alternately opens and closes the main line circuit, making a block signal which the operator cannot change without notifying the central office.

A frame for power drilling machines has been patented by Mr. John S. Wallace, of Nelsonville, Ohio. It has a cylinder with apertures near one end, an inlet pipe with a valve, and a pawl pivoted on one end of the cylinder, in combination with a piston operating in the cylinder and carrying rack teeth engaged by the pawl, with other details, making a frame especially adapted for quick adjustment in mines.

AGRICULTURAL INVENTIONS.

A combined cotton chopper and cultivator has been patented by Charlie L. Ferriott, of Armour, Texas. It is constructed in such a manner as to bar off the rows of plants, chop the plants to a stand, and dirt the standing plants, at one passage along the rows, the construction being simple and the machine being easily controlled.

A listing cultivator has been patented by Mr. William R. Wilson, of Waterville, Kansas. It can be attached to any ordinary cultivator, and is designed to level the ridge between the rows and work the dirt gradually to the corn without injuring it, leaving the ground level, so that it can be worked as easily as planted corn with an ordinary cultivator.

MISCELLANEOUS INVENTIONS.

A fence machine has been patented by Mr. George W. Williams, of Economy, Ind. This invention covers a novel form of tension device, and a peculiar twisting device, for cheap, durable, and efficient fence building.

A machine for making veneer dishes has been patented by Messrs. Charles H. Treat and Andrew B. Banghart, of Georgetown, Del. This invention covers a novel construction, combination, and arrangement of parts in a machine designed to saw out the veneer disks and form the dishes in a continuous operation.

A dispensing apparatus for soda and mineral waters has been patented by Mr. George A. Hearn, Jr., of New York City. Combined with a decorative counter, which is itself a refrigerator, are the necessary coils, connections, ice and sirup jars, with self-measuring distributers, a suitable ice cream repository, and other novel features.

A photographic camera has been patented by Mr. William H. Lewis, of Brooklyn, N. Y. The invention covers novel means for focusing and indicating the focus in connection with a sliding ground glass and plate holder carrier and a lens or lens tube, which has or may have a fixed position, with other new and useful features.

A garment supporter has been patented by Mariana T. Jones, of Boston, Mass. It consists of an upper garment supporter loop provided with a spring strip or loop, the object being to provide means whereby the upper loop, usually caught upon the button of the waistband, will be held to the button and prevented from accidental displacement.

A bathing stove has been patented by Mr. Gustav Boegler, of Carlsruhe, Baden, Germany. The invention consists of a boiler mounted above the fireplace and provided with a central conical compartment, having a downwardly extending flue with water circulating pipes, making an improved stove for heating water as well as rooms.

A riveting machine has been patented by Mr. John S. Snedeker, of New York City. It consists of a vertically sliding tool holder carrying the tool, and an adjustable rivet block having a seat for the head of a rivet, the machine being specially adapted for riveting the ends of hoop iron together without first punching a hole.

A churn dasher has been patented by Mr. Martin O. Dolson, of Wichita, Kan. The dasher rod has screw wheels so arranged that they revolve in opposite directions when forced up and down through the cream, making a dasher which is simple and inexpensive, and which may be easily taken apart for cleaning.

An artificial tooth crown has been patented by Mr. George A. Colomb, of Convent, La. It is composed of an outer composition shell and an incorporated hollow metal structure, making a tooth crown of novel construction, to be inserted on the roots of natural teeth, which it is designed to seal up and protect from decay.

A motor has been patented by Mr. Josiah P. Watson, of Leesburg, Texas. It is designed as a cheap and efficient churn power to be used in connection with the ordinary form of vertically reciprocating dasher churn, and the invention covers various novel features of construction and arrangement of parts.

A key for stringed instruments has been patented by Mr. Hiram W. White, of Yankton, Dakota Ter. A shaft is mounted to have a sliding movement in its bearings and carrying a loosely mounted pinion, with means to effect the coupling of the pinion, a worm gearing with the pinion and having its shaft supported in open-ended sockets of brackets.

An animal exterminator has been patented by Mr. William H. Leininger, of Salem, Oregon. The invention consists essentially of two cylinders, one arranged to fit over the other, and with a valve of novel construction, making a convenient device for forcing a volume of smoke within the burrows of squirrels and other animals.

An animal trap guard has been patented by Mr. William R. McCracken, of Brady, Ohio. Combined with the toothed jaws are guards of less width than the jaws, and extending above and in alignment with them, whereby an open space is left between the guards over the teeth of the jaws, to prevent animals caught in the trap from guawing themselves loose.

A box for holding ruffling has been patented by Mr. Abraham H. Engel, of New York City. It is a simply constructed receptacle, designed for shopkeepers' use, and is so made that the goods may be held therein and advantageously exhibited and measured off to customers without exposing or handling the whole piece or length of goods.

An egg preserving compound has been patented by Nils Colling Jurgens, of Clifton, Texas. It consists of a composition consisting of silicate of sodium, gum arabic, sugar, and water, the compound to be applied by dipping or in any other way so as to effectually exclude the air, and by which eggs may be kept a long time without regard to the weather.

A pencil sharpener has been patented by George R. Lewis and Helen L. Bowman, of Lamoille, Ill. It is a rectangular box with a cover, to which are attached one or more sheets of sandpaper, and hung on hinges formed of cranked or offset wires, arranged to close the top of the box or rest in an inclined position, so the dust from the pencil points will go in the box.

A key board attachment for pianos and organs has been patented by Mr. John H. Rheem, of Ottumwa, Iowa. The invention consists of a box supported over the key board and provided with a device for operating five keys by pressing on two levers at a time, the levers projecting from the top of the box, and there being a device for indicating different keys.

An embankment protector has been patented by Mr. Abraham M. Kanters, of Holland, Mich. It consists in a covering of willow branches, cane, bark, cornstalks, or other flexible material, to the required depth, fastened by means of stakes and cross wires, the stakes having conical or pyramidal points applied to and projecting beyond their lower ends.

A hand power attachment for sewing machines has been patented by Mr. James M. Cosby, of Elberton, Ga. This invention covers a combination of a lever having a spring fulcrum and a special pitman adapted to connect the lever with the treadle of the machine, whereby the machine may be operated by hand through a lever operating in unison with the treadle.

A hand ironing machine has been patented by Mr. Frank Corbett, of New York City. Combined with a closed casing are inclosed rollers journaled therein, with detachable journals and screws for holding the journals in place, the machine to be heated by placing in a frame, so that all the heat will be combined within the casing, upon the top of a stove, range, or furnace.

A horse detacher has been patented by Mr. John A. Berg, of Ashburton, New Zealand. It consists of a special device of shaft or thill coupling, giving increased facility for detaching the shafts or pole of the vehicle, and so that it can be done by the driver from his seat in case the horse runs away, while giving a firm and substantial coupling for ordinary use.

A wagon box has been patented by Mr. Francis Fisher, of Scotia, Neb. Combined with the wagon body is an upper removable section, hinges connecting the body and upper section, with handles rigidly connected to the upper leaves of the hinges and free at their lower ends to strike the sides of the body and support the sides of the upper section in an inclined position, with other novel features.

An adjustable bed for invalids has been patented by Mr. James Miller, of Adelaide, South Australia. The invention covers novel features of construction in a bed which may be swung sidewise to cause the invalid to take any desired position on either side, and also may be adjusted at its head portion to support the upper part of the body as wished between a lying and sitting posture.

An egg carrier has been patented by Mr. Augustus Heliner, of St. Elmo, Col. It is constructed with inner cells and an outer case, being preferably made of paper, the outer casing having a removable top, and a light base piece having upwardly extending wires connected with a detachable handle, making a light, strong, and cheap carrier, which may also be used for fruit and other articles.

An attachment for smelting furnaces has been patented by Messrs. Elliott R. Moffet, Jr., and Oliver R. Moffet, of Joplin, Mo. It consists of a series of pokers arranged to be operated from the side, and to be thrown inward and upward by a shaft turned by a crank, the pokers being arranged in connection with a shovel or plunger, to obviate the necessity of standing in front of the fire when stirring or poking it.

A feed grinder has been patented by Messrs. Isaac and James C. Jay, of Arapahoe, Neb. With the frame and hopper and its support is a reciprocating grinding plate and a rocking grinding cylinder, with cranks and driving mechanism arranged to grind the grain as it passes between the plate and cylinder, the machine being simple in construction, but readily adjustable to grind different kinds of grain.

A mechanical movement has been patented by Mr. August C. Arneson, of Clark's Grove, Minn. It consists in an annular internal gear supported on a suitable frame, with shaft journaled axially to the gear and having a gear wheel, between which and the annular gear is placed a traveling pinion on a tumbling rod connected with the driving shaft by means of a universal joint.

A supporting column for drilling machines has been patented by Mr. Millard F. Smith, of Weir City, Kansas. The operating mechanism of the machine is carried by a single post, which is so arranged that it may be swung upon screws, by which it is supported and upheld without in the least interfering with the rigidity of the connections, the machine being more especially applicable for the drilling of coal.

An apparatus for preserving eggs forms the subject of two patents issued to L. Adelle Hapgood, of Randolph, N. Y. It consists in a tilting case containing trays made of slats, in which are fitted comparted frames made shorter than the trays and arranged to slide therein, there being yielding cushions at the ends of the trays for preventing the breaking of the eggs, so they may be readily turned for preservation, and stored or shipped.

A fence building machine has been patented by Mr. W. H. Harry Fauber, of Marshfield, Ind. This invention provides a light, portable hand fence building machine, wherein the tension upon the wires employed to bind the pickets to place may be varied as desired, and also provides a novel form of twisting attachment and an operating mechanism therefor, means for accurately adjusting the pickets as to height, and other novel features.

An apparatus for dyeing skeins has been patented by Messrs. Charles Meadowcroft and Peter Denanhouer, of Philadelphia, Pa. It is calculated for dyeing skeins of silk, wool, etc., and made to readily govern the number of revolutions of the carrying frame, while the latter will be automatically elevated from the vat when the set number has been reached, the frame being adjustable to any size of skein, and designed to carry them so they will not become tangled.

The ventilating of tobacco curing houses forms the subject of a patent issued to Mr. Nelson Bruette, of Jefferson, Wis. The general features of construction called for by this invention are close sides, with base ventilators fitted therein, a turret ventilator, with rotatable body having opposite closed and open sides, with pivoted vanes and means for raising and lowering them, whereby a downward or upward draught may be induced through the curing house by arranging the vanes and the base ventilators.

A machine for casting and finishing type has been patented by Messrs. Leon and Auguste Foucher, of Paris, France. Combined with a carriage which slides on a fixed block are knives or cutters to cut or trim the top and bottom sides of the type, the carriage having a jaw which, together with the top cutting knife, carries the type to the bottom cutting knife, a plunger being pressed downwardly by a lever acted upon at its one end by a cam track, with other novel features, for making type ready for use.

A pneumatic clock has been patented by Mr. Rudolf C. Wittmann, of East New York. Combined with gearing operated by weights are two wheels revolved at intervals by the gearing, rods or bars being connected with the wheels, and tubes having compressible bulbs, which can be compressed by the rods, compressible balls at the other ends of the tubes carrying the bulbs, and mechanism connected therewith to revolve the wheels, with other features, whereby a number of hands on different dials can be operated from a single clock.

NEW BOOKS AND PUBLICATIONS.

A SYSTEMATIC HANDBOOK OF VOLUMETRIC ANALYSIS. By Francis Sutton, F.C.S., F.I.C. Fifth edition. Philadelphia: P. Blakiston, Son & Co. 1886. Pp. 491. 90 illustrations.

We need only say that this work is welcome as bringing Sutton's Volumetric Analysis down to date. The original book has been so long the standard, and is so well known, that description seems hardly necessary. Under the section devoted to gas analysis, one of the most valuable features of the work, we find the Hempfel and one or two other recent apparatus described. The production of new and revised editions of standard works is a movement in the right direction, provided they are well in advance. The determination of carbonic acid in air has so very recently been satisfactorily worked upon, that we can pardon the little said upon this subject.

TABLES FOR THE DETERMINATION OF COMMON MINERALS. By W. O. Crosby. Boston: J. Allen Crosby. 1887. Pp. 74.

This work is a useful one, but its utility would be enhanced had it been extended to include more minerals. The tables are strictly determinative ones, and the characteristics of the different species are given in columns, in the order of morphological, physical, and chemical properties. All the tests represented under these three heads are what may be termed working or field tests. A careful review and description of these methods precedes the tables. A list of apparatus and reagents especially for blowpipe work comes next. A synopsis of the rational classification of minerals into sub-kingdoms, and these into classes, is given. Next comes a general empirical classification, founded entirely on luster, color, streak, and hardness, and referred by page numbers to the tables. The tables follow, the first column of which contains an analytical key, by which the empirical classification is continually referred to. The remaining columns of the tables cover species name, composition, luster, color, streak, hardness, tenacity, specific gravity, form, cleavage, other properties, and confirmatory chemical tests. In reducing the role of chemistry to the subordinate one of confirmation the author has done wisely, as the aim of the student of mineralogy should be to recognize minerals by their appearance and external characteristics. A useful note on how to use the tables, and an index of the 189 minerals described, ends the work. We regard it as an admirable effort in a somewhat neglected field, and should hail the appearance of a more comprehensive treatise on the same lines with much pleasure.

L'ANNEÉ ELECTRIQUE, OU EXPOSÉ ANNUEL DES TRAVAUX SCIENTIFIQUES DES INVENTIONS. By Ph. Delahaye. Baudry & Co., Publishers, 15 Rue St. Peres, Paris, France. Pp. 380.

This work is a review of the progress made in the application of electricity to the arts and industries during the year 1886. The book appears to be carefully prepared, and is written in an agreeable style. It is divided into several divisions, treating of such themes as electric lighting batteries, the telegraph and telephone, electricity in the atmosphere, electricity as employed in medicine and on railroads, and its uses as a motive force on tram cars, etc., electrolysis, metallurgy, etc. It presents much information in a practical form, suitable for ready use and reference.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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Niagara Steam Pump. 20 years before the public. Always first premium. Adapted for all purposes. Norman Hubbard, Manufacturer, Brooklyn, N. Y.

Manufacturers' Advertising Bureau, 8 Broad St., N. Y. Benj. R. Western, Treas. Managers of advertising for firms. 20 years' experience. Best references.

Machine drawing and designing. A. K. Mansfield, Chicago.

Rollstone variety lathe—bores, beads, and turns at the same time. Rollstone Machine Co., Fitchburg, Mass.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

The 9th edition (22d thousand) of "Trautwine" appeared in March, 1885. It was larger than its immediate predecessor by over 150 pages, the new index alone being more than twice as large as that of the 8th edition. Many of the old articles were modernized, and many new ones added. The present edition contains still further improvements.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) Copper asks how to stick copper coins to a plain board. A. Use shellac or sealing wax, applying it to the board and pressing down on it the heated coin. If you refer to the trick, see SUPPLEMENT, No. 279.

(2) T. D. McC. writes: I want to use some electric light carbons in a sal ammoniac battery. Will nitric acid be a good thing to remove the thin coating of copper from the carbon? Or, if not, what will? A. It is the best, and will be very effectual. Do the work out of doors, on account of gas evolved.

(3) J. P. asks: Will you please give receipt in your next issue to make a whitewash that will stand the weather, and also what to color with to make a deep slate color? A. Slake ½ bushel lime, strain, and add a peck of salt dissolved in warm water, 3 pounds ground rice put in boiling water and boiled to a thin paste, ½ pound powdered Spanish whiting, and a pound of clear glue dissolved in warm water. Mix these well together, and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace, and when used, put it on as hot as possible, with painters' or whitewash brushes. Color to suit by adding sparingly of a dry pigment.

(4) W. F. C. asks how many Leclanche cells it ought to take to ring a bell through about 900 feet of No. 12 galvanized wire with good ground connections at each end. Can I ring a bell with a ground circuit? A. Two Leclanche cells should suffice. You can use a ground connection.

(5) L. V., Sacramento, Cal., asks: 1. Can you tell me a simple, inexpensive way of preparing India ink so that it will keep in a liquid state, without becoming mouldy or losing any of its qualities? A. The addition of a few drops of oil of cloves, oil of almonds, or carbolic acid will prevent its becoming mouldy, and it may thus be kept a long time; there is no good way of keeping it permanently liquid. 2. I have a glass inkstand with a brass hinged cover; by an accident the cover was detached from the stand; can you tell me how to make a paste that will unite them? A. Use plaster of Paris. 3. Can you tell me how to make lather for cleaning windows that is merely rubbed on the glass, and when dry brushed off? A. Mix 1 part of olive oil, 1 part of spirit of sal ammoniac, 2 of lime, and 1 of water to a thick paste. 4. What colors unite to form the color of gold? A. Use a combination of yellow and red until the desired shade is attained; the peculiarity of gold is its metallic luster, which of course cannot be obtained by any combination of tints.

(6) C. G., Baltimore, Md., asks: How can I restore the pliability of gas gum bags that have become hard? A. To a limited extent rubber can be restored by immersion in coal oil.

(7) H. E. B. writes: I have two powder horns that have been hanging in a cupboard for some time. On looking them over recently, I find that there are several holes eaten or bored through them. The holes are about one-eighth inch in diameter, and look like the work of the apple tree borer, but no insect was visible. Can you explain what made the holes? A. Professor Howard, of the Department of Agriculture, Washington, says that objects made of horn are not infrequently subject to the attacks of insects of various orders, and notably of Coleoptera of the families Dermestidæ and Ptinidæ. The latter family (*i. e.*, those species which have been observed to bore in horn) are too small for the size of the holes mentioned, but this size agrees very well with the holes made by species of the genus *Dermestes*, and among the various species of this genus, *D. vulpinus* is most likely to have done the mischief. An accurate determination of the species in question is not possible, however, without seeing the specimens themselves. Frequent handling of objects made of horn, or exposing them to sunlight, will effectually protect them.

(8) Z. R. B. asks the best present method of japanning tin trousers buttons in large quantities. A. Tin buttons to be japanned should first be heated on sheet iron pans just hot enough to oxidize the tin slightly without melting it. This is to make the japan stick, as it is liable to crack off from bright tin. For dip work string the buttons on fine wire stretched across a bow made of larger wire, a hundred or more on a string. Make the bow with a loop to hang by. Heat the strung buttons, in the oven and dip in a long trough of Japan varnish thinned with turpentine to the proper consistency for the work. Hang the bow on a hook in the oven and touch the beads on the buttons with a wire to draw off the excess of Japan varnish. Bake at a temperature suitable for the kind of varnish used, say 250° to 280° Fah. For a finer finish the buttons should have two coats, the first a very thin one and the second a thicker and better varnish. There is a hand way used by placing the buttons on little studs made of wire set in a piece of board or sheet iron, the studs having shoulders to hold the buttons at the top, so that the varnish can be put on with a brush, which enables the use of a stronger varnish thinly laid on. Bake the buttons on the pins.

(9) J. I. B. asks how to get the condensed steam or water that drains from the heating pipes of a factory back into the boiler again by some automatic method. The drain pipes are several feet above the water level of the boiler, and there is a check valve near the boiler, but the water will not go back. A. We fear that you have not given the full pressure of the boiler to the coils, as in a return system of several feet above the water line you should have a perfect circulation through your coils, and the condensed water should flow back to the boiler by gravity. To accomplish this in a satisfactory manner the steam pipe should be large and the valve wide open; the steam connections with the coils should also be proportionately large, and the valves always wide open when steam is required on the coils. Every coil should have an air valve, to avoid frequent blowing out to free the system of air. If your pipe work is defective in its proportions, so that you cannot carry the full pressure into the coils, you may have to consider the cost of enlarging the pipes or of adding a return steam trap near the boiler, which will overcome the difficulty, at a cost of about $150.

(10) J. W. K. writes: I have a great number of articles made of cold rolled steel, about 2 inches or 3 inches long, ⅛ inch wide, and varying from a fiftieth to one hundredth of an inch in thickness.] The steel is of good quality. I want to harden them tolerably straight. When heated and plunged in water or oil, they are curled and cockled in all shapes. What is also the best method of tempering these articles? A. The hardening of thin pieces of steel of the character described should be done by dipping each piece separately and vertically into the water or oil. No miscellaneous dumping will bring them out straight. A pot of lead at full red or cherry red heat is the best for heating. Dip each piece vertically in the lead, and also vertically to harden. If a sand bath is used for heating, there is much trouble in picking out such thin hot pieces without bending. If the pieces are of such form as to be strung on wires half a dozen at a time, the process becomes less tedious. A method of hardening between cold surfaces of iron for perfectly flat and thin work has been practiced with good results where hardness and flatness are required. If a full spring temper only is required, the pieces may be hammered flat after bluing, as in the saw trade. Possibly, if the pieces are now made from the rolled steel without annealing before heating for hardening, you will find your trouble in regard to curling. We do not think it possible to heat rolled thin steel and harden it without previous annealing by any known method, other than by compression between cold dies.

(11) T. H. B. writes: I am building a launch 20 feet long, 26 inches beam, 6 inches draught, very fine lines, and wish to fit with twin screws. What diameter and pitch would be most suitable, and what speed could I probably obtain with 4 horse power? Could I use two De Bay propellers on above boat with any gain in speed over Thornycroft's or other makes? If so, what diameter, pitch, and speed would be best? What is the highest speed at which 2 and 4 inches diameter cast steel bevel gear wheels can be run with safety and economy, if accurately cut? A. As your boat is of very shallow draught, you will have to immerse the screws below the keel for good effects. Use a pair of 12 inch wheels, right and left blades, 30 inches pitch. You should be able to obtain a speed of 8 miles per hour with 4 horse power, and will need to make 325 turns per minute for this speed. Steel gearing on shafts 3 inches diameter with 5 inches driver, giving the engine 195 turns per minute, will give effective service. We do not recommend the De Bay propeller screw; it is too complex. The Thornycroft is good, but not in use for yacht launches. The plain radial wheel, with 2 or 3 blades, has been most approved in late practice.

(12) C. G. Van B. asks: 1. What is the best method of soldering the ends of fine copper wire together, especially for use in the secondary coil of an induction coil? A. Silver solder with vitrified or melted borax as the flux is the best material. You will find it a very delicate piece of soldering to unite such fine wires. You must use a blowpipe. 2. What are the objections, if any, to using resin as a flux for such purposes? A. Resin is the best ordinary flux for use on apparatus where it will make the solder take hold. Soldering acid should be avoided if possible. The following is recommended as a substitute: Lactic acid 1 ounce, glycerine 11 ounces, water 8 ounces. 3. How to re-tin soldering coppers. A. File them to a clean, even point, filing until no pits or depressions are left in the faces. Heat them to a fair temperature, rather hot, dip for an instant in a solution of sal ammoniac, and then rub on a block of solid sal ammoniac with some solder. Turn the iron around continually. Or for the block of sal ammoniac you may substitute a brick, into which you have made a slight depression and put resin and some solder in it. Rub the point up and down against the depression until tinned.

(13) J. H. B. asks how to increase the strength of a magnetic horseshoe magnet and keep it strong. A. You may preserve its strength by keeping its armature in contact with its poles. This will hardly increase its strength; you will do well if you can preserve it unimpaired.

(14) G. R. T. writes: I have a tennis racket on which the stringing is getting a little loose, but not enough to have it restrung. Please let me know whether there is any varnish I can put on to make them contract, or what I can do to tighten them without taking it apart. A. Oiling the strings with linseed oil is effectual to a certain extent. Restringing is the only good and certain cure.

(15) G. S. writes: I have seen an acid used for cutting steel, for making steel dies deeper, and giving a dead finish to the work. What seemed strange to me was that it would not touch the steel until it was touched with a piece of zinc. A. It is dilute nitric acid, 1 to 10 with water. The zinc is used to establish a galvanic current, which starts the acid into action on the steel. It must be brought for a very short time into contact with the steel and acid.

(16) F. N. D. asks: Why are the years 1800 and 1900 not leap years? A. The true solar year in length is 365 days 5 hrs. 48 min. 46·054 sec. Hence the correction by adding one day in every four years overcorrects it, and the annual excess of 11 min. 13·946 sec. amounts in a century to about eighteen hours, or in four centuries to three days. Therefore, a further correction is introduced by making but one out of four centurial years a leap year. This is so nearly correct that an error of only one day in 3,325 years is introduced. Those centurial years are leap years, the first two digits of whose numbers are divisible by four without a remainder.

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INDEX OF INVENTIONS

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March 29, 1887,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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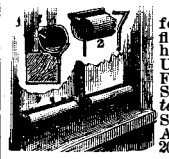
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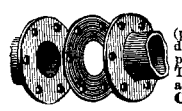
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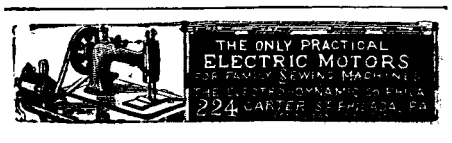

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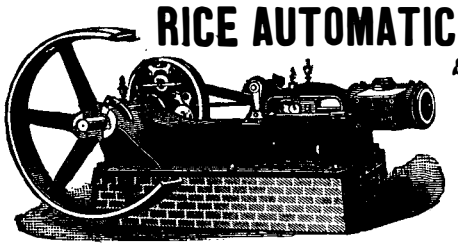

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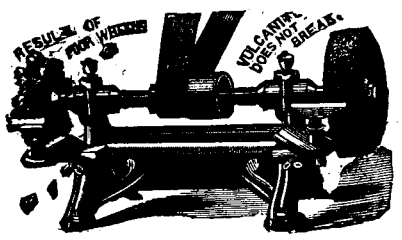

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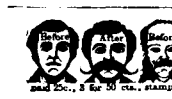

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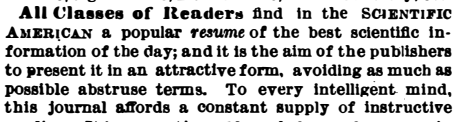
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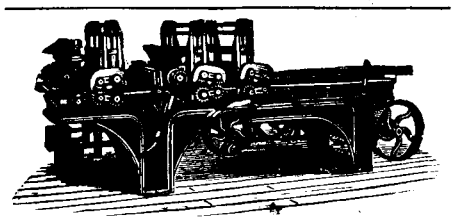

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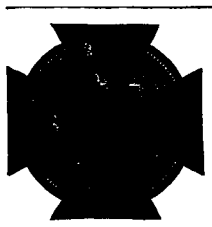

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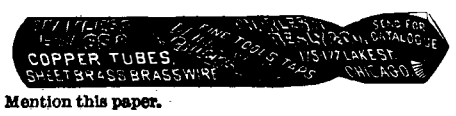
VAN DUZEN & TIFT, Cincinnati, O.



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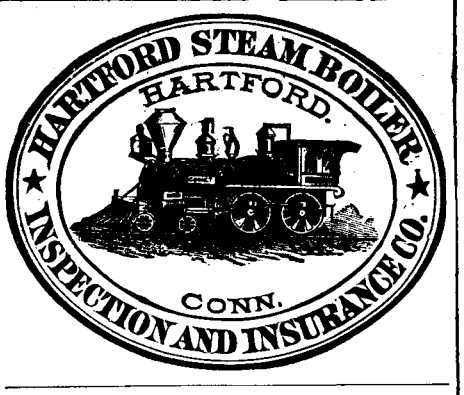

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